COTTON

with which is combined

BOSTON JOURNAL OF COMMERCE AND TEXTILE INDUSTRIES and SOUTHERN MILLS.

Vol. 73 ATLANTA, GEORGIA, JULY, 1909. No. 9

PUBLISHED MONTHLY BY

COTTON PUBLISHING COMPANY

ATLANTA, GEORGIA, U. S. A.

CHICAGO, BOSTON,
PHILADELPHIA, NEW YORK,
TORONTO, CANADA CLEVELAND, O.

Address European correspondence to

THE SECRETARY.
MANCHESTER COTTON ASSOCIATION,
22 St. Mary's Gate, MANCHESTER, ENG.

SUBSCRIPTION RATES

DOMESTIC..... FIFTY CENTS PER YEAR
CANADA..... $1.00 PER YEAR
FOREIGN..... $2.00 PER YEAR.

Contributions and practical letters solicited.
All accepted matter will be paid for liberally.

Entered at Atlanta Postoffice as Second-class Matter.

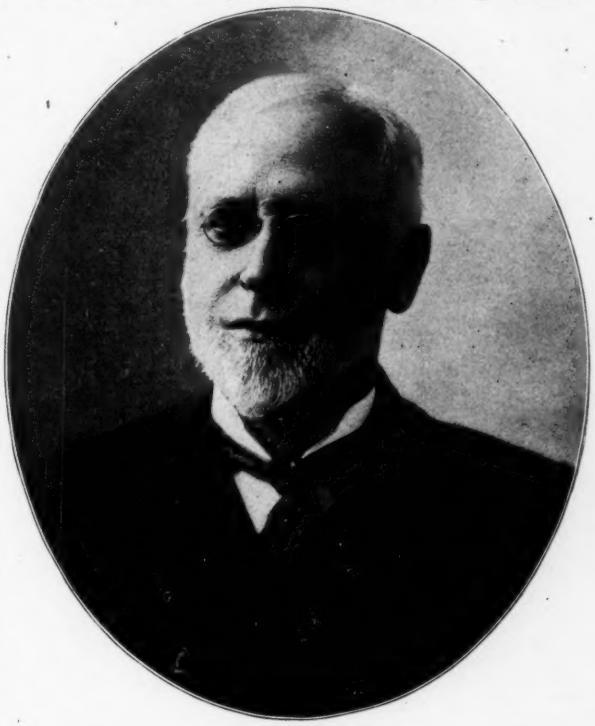
Contents.

Henry G. Kittredge 346
Cotton Crop for 1909-10 346
Attitude of the Southern Mill Toward the Tariff 347
Premiums with Subscriptions to COTTON.....348
The Georgia Industrial Association in Convention.....348
Meeting of South Carolina Cotton Manufacturers' Association 351
Decreased Consumption in China of Foreign Spun Cotton Yarns 351
The Aim of The Textile School 351
Textile Exhibitors' Association 352
Cotton Culture in Egypt 352
Influence of Long Distance Power Transmission on the Textile Industry 353
Why Tariff on Hosiery Should be Increased 355
Water Supply from Wells for Textile Mills 356
Textile Trade in Germany 358
Induced vs. Natural Draft 358
Processes in Cotton Manufacturing 360
The making of a Thread 362
Drum and Stud Gears for Twisters 364
Yarn sizing 365
Preparation of Colored Warps for the Loom 366
Practical Points on Loom Fixing 366
Twist in Woolen Yarns 368
Imparting Special Properties to Textiles 369
The Needle in Loop Wheel Machines 370
Knitting Machinery in Japan 372
Chemicals Used in the Textile Industry 373
The Thio-Indigos in Mechanical Apparatus 375
Power Consumption of the Spinning Frame 376
Flyer Lead and Bobbin Lead 376
The Cloth Room 377
Questions About a Slasher 377
New England Mill Situation 378
Southern Mill Situation 378
Cotton Market 379
New Machinery and Trade Notes 380
The Automatic Intercommunicating Telephone in Cotton Mills 79

HENRY G. KITTREDGE.

Henry G. Kittredge, editor of COTTON, died in Atlanta, Ga., June 5, 1909. He was the son of Thos. B. Kittredge, a celebrated physician and surgeon.

Mr. Kittredge was identified with the textile industry throughout almost his entire life. As a young man he was engaged in the manufacture of woolen goods in Fitchburg, Mass., rising from superintendent to mill owner. On the retirement of Thos. Pray, Jr. and Jos. M. Wade from the old *Boston Journal of Commerce*, Mr. Kittredge became



editor of that publication, with which he was identified for fifteen years. He then became interested in the *Industrial Record of New York;* and when it was merged with the *Textile World* Mr. Kittredge continued the editor, leaving it after four years to accept the industrial editorship of the *New York Commercial.* He was one of the founders of and the editor of the *Textile American* until he came to Atlanta in 1907 to assume the editorship of COTTON.

Mr. Kittredge's early familiarity with cotton was acquired on a Southern plantation where he resided for a time and where he gave much attention to the scientific study of the staple with special reference to its adaptability to manufacture. Following a natural inclination he took up the economic and practical literature of textile manufacturing, devoting his time and thoughts to this subject until his death. He wrote much on textile subjects

and lectured extensively. In addition to his many contributions to magazines and textile journals, he read several papers before the textile manufacturers' associations and received the 1905 medal of the New England, now National, Cotton Manufacturers' Association for a paper on the "Economic Extension of Cotton Cultivation in the South." Mr. Kittredge was a tireless worker and student to the end, having recently made microscopic examinations of a number of samples of cotton furnished by his readers and which were of much interest to him on account of the diseases to which the staple is heir.

He was always actively and deeply interested in everything that pertained to the upbuilding of the textile industry. He organized the American textile exhibit at the World's Columbian Exposition held in Chicago in 1893, acting as a member of a committee of which he was chosen chairman and appointed by the National Association of Woolen Manufacturers. In 1895 he was appointed by the governor of Massachusetts on the commission to represent the commonwealth at the Atlanta Exposition together with the Hon. Curtis Guild, Jr., and the Hon. Wm. C. Lovering. Mr. Kittredge was also responsible for the organization of the United States textile exhibit at the Paris Exposition in 1900 and selected such exhibits as procured for the manufacturers of this country "Grand Prizes" and "Gold Medals" in all but one instance.

He was a member of the National Geographic Society; a member of the national committee of the Sir Wm. H. Perkins Jubilee in 1906 in commemoration of the discovery of mauve and was one of the chosen speakers at the New York banquet given for the occasion.

He was textile technologist for the Century Dictionary and Cyclopedia.

He enjoyed the personal acquaintance of hundreds of American mill owners, and there are few well informed men in the textile field who are unfamiliar with his name and writings and many by whom his death will be sincerely regretted.

Mr. Kittredge had been for many years deeply interested in the collection of all the best books and printed matter relating to textiles, and leaves, without doubt, the most complete library on this subject in existence. Just previous to his illness he attended the annual convention of the American Cotton Manufacturers, Association at Richmond, Va. Upon returning to Atlanta he began at once the preparation of his report of the convention for publication in the June issue of COTTON and though not feeling well he completed this report and all other matter for the June number before being compelled to leave his desk.

From his organized staff of contributors Mr. Kittredge had accumulated and had in preparation a mass of technical papers. Thus, and he spoke of it with pride but a few days before his death, he had outlined and largely determined the editoral policy which will govern COTTON'S reading pages for many months to come.

Through his uniform geniality and courtesy Mr. Kittredge had endeared himself to every member of COTTON'S staff and in its office as well as throughout the wide circle of his friends, elsewhere, his loss is keenly felt.

In St. Etienne, France, with the exception of velvet and high-grade fancy ribbons, for which this city has gained renown, the weavers have no specialty.

Inquiries about anything pertaining to the textile business will be cheerfully answered by COTTON.

THE COTTON CROP FOR 1909-10.

BY JOS. B. LIVELY.

(*Written exclusively for* COTTON.)

Of the cotton crop for the season of 1908-09 there had been marketed up to June 25, 13,269,913 bales. These figures represent the third largest crop ever gathered. In the last five years there have been marketed 63¼ million bales of cotton by the farmers of the "Cotton Belt" of the United States. Included in the five years of apparent bountiful supply of cotton, there was the severe panic which caused world-wide depression in all markets and forced universal short time by the spinning industry, both at home and abroad, and complete shut-down in other lines. Coming as it did, when prosperity was running at high tide, it found some of the mills, especially those of America, with heavy stocks of goods, manufactured from high-priced raw, without a market. In order to dispose of the accumulated stocks the mills resorted to short time, at times closing down for a month to six weeks. By this operation the stocks were slowly worked off, but in many instances at a loss.

However, taken as a whole, the cotton manufacturing business was the first to adjust itself to the changed conditions, and by reducing the prices of its products as soon as the laws of supply and demand required it, the industry recuperated at an amazing rate and the mills were running fairly well, when some other industrial lines were doing practically no work at all.

This encouraging condition was commented upon by the leading financiers of the North, and acted as a powerful stimulant in the rehabilitation of the various industries which were slower in the adjustment of their business to the changed conditions.

It is evident that the depression of 1907 prevented a cotton shortage.

The commercial crop for that year aggregated 11,571,966 bales, a total somewhat less than the world's average requirement.

For the coming year, indications point to the largest consumption in the history of the trade. It is known that the merchants throughout the country have been pursuing a hand-to-mouth policy in the purchase of goods, due to a general hesitation of the trade; that their shelves are bare of stock; that the business situation is now showing distinct signs of improvement, and that it is only a question of a very short time when they will be forced into the market for full supplies. The mills throughout the world have anticipated this condition and are making preparations to meet all requirements made upon them.

In England many new mills have been built, while the old ones have been enlarged by the addition of new machinery, and otherwise generally improved.

"The Blue Book," just issued, on the progress and condition of India during the year 1907-8 shows the rapid progress made by the cotton manufacturing industry. In 1883-4 there were 74 cotton mills, with a capital of five and a half millions sterling, 16,251 looms and 1,895,284 spindles. In 1907-8 the cotton mills numbered 227, with a capital of 13 millions, 66,718 looms and 5,763,710 spindles. The majority of the cotton mills—namely, 161—are in Bombay Presidency, and they contain 71 per cent. of the spindles and 80 per cent. of the looms. Although the last two years have been unfavorable and some mills have worked short time or not at all, the industry has continued to develop. The production of yarns of counts above No. 25 has increased, and these finer yarns now con-

stitute over 9 per cent. of the total. Imports of yarn amount to only about 5½ per cent. of the Indian production, but a very small proportion is of counts under 25. Phenomenal profits were realized in the cotton industry in 1905-6. There was a decline in prosperity during 1906-7, which became accentuated in 1907-8. The output of the mills was restricted owing to poor crops and to the disorganization of trade with the far East, especially China, which is the principal market for Indian yarn.

In New England $53,500,000 will be expended in building new mills and in making improvements in the older plants.

In the South mill building has never ceased. Even through the depression new mills sprung up in different sections, and additional spindles and looms were installed in the older mills. In the South there will be a decided increase in the consumption of cotton over last year.

To keep all machinery supplied with raw material, that up to the present time can only be satisfactorily produced in a comparatively small strip of country in the South, is a question that is being seriously discussed. Efforts are being made to discover climatic and soil conditions similar to those of the South for the cultivation of cotton.

Experiments are being made in the West Indies with some success, according to a report of the Liverpool Chamber of Commerce at its last session. The report follows:

"During the year they had a visit in Liverpool of the delegates from the West Indies in the interests of cotton-growing. In these interests the Cotton-Growing Association and the Chamber of Commerce had acted with a very great wisdom. The cotton grown within the empire was quite capable of supplying the cotton requirements of Lancashire, and, sooner or later, they were bound to recognize that the Americans, increasing their population as they were doing, must soon require the whole of the cotton they produce. In the meantime the public would be delighted to know that the cotton-growing experiments had been an enormous success. In the present year they should produce at least 20,000 bales of British-grown cotton. The cotton was well liked, well taken, and was selling very rapidly in Liverpool."

Prospects for an adequate yield of cotton for the coming season are not encouraging at the moment. The start has been late and since planting, atmospheric conditions have been adverse to germination and a healthy growth. A period of prolonged drouth in Texas at the planting season delayed progress in that direction. Beneficial rains have recently fallen, however, and decided improvement is reported. The Government report, issued on June 1st, credits that State with a slightly increased acreage and a condition somewhat better as compared with last year.

In the eastern and central States complaint of excessive moisture is general, and intended abandonment of some of the area planted is reported. The Government report on the condition of the growing crop, on June 25, as a consequence showed deterioration as compared with the May condition report. However, an improved condition was shown in Texas.

The season is young, and much of the damage can and probably will be repaired. A short crop at this particular time, when we are just recovering from the effects of the depression, would be a severe drawback. From a speculative viewpoint it is almost a certainty that the 1909-10 crop will be a short one. The forecast is based on the recent unfavorable weather, spread of the boll weevil and the decrease of 1,452,000 acres, as compared with last year. A study of the acreage and yield discloses the peculiarities of the cotton plant and the difficulty of calculating anywhere the actual yield based on the acreage. The following table gives the acreage and commercial value and shows that acreage figures are misleading:

Season.	Acreage.	Value.
1909-10	31,918,000	.....
1908-09	33,370,000	*13,269,913
1907-08	32,060,000	11,571,996
1906-07	32,049,000	13,510,982
1905-06	27,400,000	11,345,988
1904-05	31,730,000	13,565,885

*Marketed up to June 25.

In the season of 1904-5, as above, the largest crop in the history of cotton was raised on 31,730,000 acres, the total crop footing up 13,565,885 bales. The Government's estimate of the acreage for the season of 1909-10 was 31,918,000 acres—a small increase in favor of 1909-10. There is a chance to equal the 1904-5 yield, the small increase in acreage about offsetting a lower condition. Favorable weather will result in great and rapid improvement in crop conditions. Any change that occurs in the near future must be of a favorable nature.

It is generally conceded that in future the yield of American cotton must exceed 13,000,000 bales to meet the world's requirements.

ATTITUDE OF THE SOUTHERN MILL TOWARD THE TARIFF.

Some time ago a letter was sent from COTTON'S office to a considerable number of the representative cotton manufacturers of the South, which asked, what action by Congress regarding the tariff would be in the opinon of the mill owner most beneficial to the Southern cotton manufacturing industry. The replies evidenced that the Southern cotton goods manufacturers are but little concerned over the question with which the country at large is so much absorbed. The majority of the replies received stated, in effect, that the writers felt insufficiently well informed on the subject to discuss it. Several expressed themselves as perfectly satisfied with existing conditions and wished no change. One recommended a general increase in the cotton goods schedules and a number advocated a removal of all duties not with reference, however, to the effect on the cotton manufacturing industry but as a principle affecting the public welfare. To these latter, in particular, the following from the editorial columns of the *New York Times* will be of interest.

"The manufacture of cotton goods enjoys more favorable natural conditions in the United States than in any other country in the world. It ought, therefore, to be able to hold its own in an open field with no favor against any possible competition from abroad.

Look for a moment at these conditions: First there is the bountiful supply of excellent raw material. That exists not only in quantities ample for our own trade but for export to our rivals who start in any competition with the handicap of 3,000 miles of transportation and the necessary expenses. Second there is the very great advantage of a large and constantly growing home market, a population of 90,000,000 of active, prosperous, and progressive purchasers, steadily increasing not only in numbers but in average consumption. To reach this market our rivals

must carry a second handicap of 3,000 miles of transportation, with all the disadvantages of dealing with a foreign people. Third there is an extraordinary command of varied and efficient labor-saving machinery, the product of a wonderfully ingenious people, stimulated by an admirable system of laws for the encouragement of invention. Finally there is the acknowldged superiority of American labor, especially in the most productive and difficult processes. On this showing, not an element in which is open to dispute, it is perfectly obvious that the cotton industry of the United States does not really need the fraction of a cent protection against any competitors whatever."

PREMIUMS WITH SUBSCRIPTIONS TO COTTON.

The tendency among publishers of magazines during the last fifteen years has been toward a constantly decreasing subscription price made partly possible through improved printing machinery but brought about, more, through the wish to make good reading so cheap that a subscriber once gained will remain a subscriber indefinitely. Congress in establishing laws to enable publishers to mail magazines at the low rate of one cent a pound did so, not with the idea of creating a favored class in the person of publishers, but with the belief that the welfare and prosperity of our nation is largely dependent upon the general information of the masses of our citizens. The design of Congress was to enable publishers to distribute the product of their presses at the very lowest price and thus to encourage reading and education. In establishing a popular subscription price for COTTON it was not the hope of the publishers to exclude other papers from the textile field. In this day of rapid progress the reading of one or even two of the best technical journals is not enough. The busy mill man may find it hard to cover any completely but his success and advancement surely depend much upon the thoroughness of his reading and one of his most important duties should be the careful study of all the textile literature that time permits.

The price at which COTTON is sold does not admit of any extra inducement in the way of premiums to the subscriber and none are offered nor have ever been since the establishment of it. On COTTON'S subscription blanks is plainly printed "Positively no subscription valid except at full price of 50c. Agents are not permitted to cut this price or offer any extra inducement. Acceptance of any such order will invalidate this subscription and a subscription so obtained will not be filled by the COTTON PUBLISHING CO." If any person representing himself as an agent for COTTON has made (as is being stated) any offer in violation of this rule he has done so without the knowledge or consent of the publishers.

COTTON'S advertising patronage has come to be one of the largest of any paper of its class. It is this patronage which, in part, enables the publishers to deliver to subscribers a magazine at a price, per copy, almost as low as such a paper as the "Saturday Evening Post."

COTTON is published first for profit but it is the belief of the publishers that the greatest profit and perhaps the greatest satisfaction, as well, will come through delivery to the subscriber the very best that the publishing organization is able to give. That the subscription price or the amount of it which reaches the publisher through his agent is not a measure of the value of the reading columns is too self-evident a fact to require demonstration to intelligent men.

COTTON'S staff of contributars numbers over twenty men, who are paid for the articles they contribute exclusively to COTTON. Some of these contributors are the authors of widely sold textile books. At a fraction of the expense it would be possible with paste pot and shears, and in an hour's time, to prepare the month's edition by clipping promiscuously from the work of others.

COTTON feels a just pride in its success and the progress it has been able to make. It has not awakened suddenly to great virtue but has, with all the force of its builders, continuously attempted to give to reader and advertiser alike the best service that the ability of its directors could produce. COTTON'S policy does not permit the publishing of slanderous and untruthful statements concerning its fellows. It hopes that its maximum of success may be achieved on its own merits alone. That it does not answer, in kind, malicious attacks is through an unwillingness to sacrifice a certain buoyancy of spirit, an objection to a descent to the "mud-slinging" level.

COTTON does not believe that the success of one paper affects, adversely, the welfare of another; rather does it believe that every step of a leader in the field makes easier and more effective the work of those who follow. Through mistaken reasoning, dullness will ever hate and ever attempt to revenge itself upon achievement, but its methods never bring a mastery of the situation. In COTTON'S office is an optimism which, we trust, is reflected in its pages. That sordid jealousy, bitter invective and enviousness of those more successful than we may never find expression in our columns to their prostitution and to the disgust of every man except he who wallows—we hope.

THE GEORGIA INDUSTRIAL ASSOCIATION IN CONVENTION.

The annual convention of the Georgia Industrial Association was held at Warm Springs, Ga., on June 11. Following President Davis' opening address, Hon. Chas. B. Landis, of Indiana, made a speech before the convention, his subject being "The American Merchant Marine."

Robert Wilson, of the Eagle and Phenix mills, Columbus, Ga., presented a paper on "The Card Room, the Soul of the Mill."

Officers and members of committees for the ensuing year were chosen by the convention, as follows:

President, J. J. Spalding, Atlanta; vice-president, J. L. Hand, Pelham; secretary and treasurer, C. D. Tuller, Atlanta.

Executive committee: J. P. Verdery, Augusta; W. T. Bryan, Athens; H. P. Meikleham, Lindale; L. C. Mandeville, Carrollton; E. W. Swift, Columbus.

Legislative committee: S. C. Dunlap, Gainesville; H. L. Johnston, Palmetto; S. A. Carter, Atlanta; F. B. Gordon, Columbus; Fuller E. Callaway, LaGrange.

Among members and guests present were: W. P. Barnes, Supt., Rushton Cotton Mills, Griffin; H. J. Bell, Pres., Jefferson Cotton Mills, Jefferson; W. T. Bryan, Treas., Southern Mfg. Co., Athens; Fuller E. Callaway, Pres., Milstead Mfg. Co., LaGrange; S. A. Carter, Pres., Gate City Cotton Mill, Atlanta; David Clark, Editor, *American Textile Manufacturer*, Charlotte, N. C.; Hon. E. A. Copelan, Mary Leila Cotton Mills, Greensboro; Jeff Davis, Pres., Toccoa Cotton Mills, Toccoa; E. P. Dismukes, Pres., Georgia Mfg. Co., Columbus; C. O. Dunson, Pres., and Gen. Mgr., Dixie Cotton Mills, LaGrange; W. S. Dunson,

Sec. and Supt., Dixie Cotton Mills, LaGrange; S. S. Evans, Sec. and Treas., Cedartown Cotton and Export Co., Cedartown; C. L. Faulkner, Supt., Mandeville Mills, Carrollton; C. D. Fuller, Pres., Exposition Mills, Atlanta; P. E. Glenn, Sec. and Treas., Exposition Mills, Atlanta; F. B. Gordon, Pres., Columbus Mfg. Co., Columbus; J. L. Hand, Pres., Pelham Cotton Mills, Pelham; W. M. Harris, Sec. and Treas., Hampton Cotton Mills, Hampton; Geo. E. Hayes, *Am. Wool and Cotton Reporter,* Boston, Mass.; R. E. Hightower, Pres., Thomaston Cotton Mills, Thomaston; T. C. Hudson, Sec. and Treas., Swift Mfg. Co., Columbus; H. L. Johnson, Pres., Palmetto Cotton Mills, Palmetto; J. N. King, Pres. and Treas. Floyd Cotton Mills, Rome; L. C. Mandeville, Pres. Mandeville Mills, Carrollton; J. D. Massey, Treas., Eagle and Phenix Mills, Columbus; A. T. Matthews, Mgr., Thomaston Cotton Mills, Thomaston; H. P. Meikleham, Agent, Mass. Mills in Georgia, Lindale; C. L. Perkins, Pres., Perkins Hosiery Mills, Columbus; W. M. Sasser, Mgr., Lawrenceville Mfg. Co., Lawrenceville; J. J. Spalding, Atlanta; Clifford J. Swift, Vice-Pres. and Gen. Mgr., Swift Spinning Mills, Columbus; Edw. W. Swift, Pres., Muscogee Mfg Co., Columbus; C. V. Truitt, Pres., Elm City Cotton Mills, LaGrange; J. G. Truitt, Treas., Elm City Cotton Mills, LaGrange; J. P. Verdrey, Pres., Enterprise Mfg. Co., Augusta; W. J. Vereen, Treas., Moultrie Cotton Mills, Moultrie; Ralph Webber, Saco and Pettee Machine Shops, Atlanta.

Dr. Jeff Davis, President spoke in part as follows:

PRESIDENT'S ADDRESS.

Your presence signifies your interest in the cotton mill industry, and that your zeal and courage have not been broken by the long period of industrial depression through which we have just passed. The year has been a very trying one, yielding practically no profits, and requiring the most careful skill and economy to prevent real loss. The continued absence of the export trade forced some of our large mills, formerly on this class of goods, on to domestics, thus straining to the breaking point the already overburdened home markets. In the two annual reports which I have had the opportunity and the honor of submitting to you, I pleaded for a greater variety of mill products, especially the spinning of high numbers and the making of the fine goods. The necessity of this was never more apparent and more urgent than it is to-day. Within the short space of a dozen years, the South has practically monopolized the coarse yarns and heavy weights in cloth. For a season the profits were sufficiently attractive to cause the building of many mills, planned and adjusted to this class of goods—all, or nearly all, depending on the home markets for their support. During the panic, the absence of orders, the large accumulation of stocks, and the enforced curtailment brought convincing proof that these goods were being manuafactured far in excess of the requirements. Many of these accumulated stocks have since been sold at a heavy loss, further proving the extremely vulnerable position in which these mills have placed themselves.

To extricate ourselves from present difficulties and entanglements and to so fortify our position as to prevent any future recurrence of such, or more disastrous consequences, are the duties and one of the objects of this Association. A greater variety of mill products manufactured for home markets will materially aid in relieving the situation.

The sure and rapid development of our water-powers, our climate splendidly adapted to the manufacture of cotton goods, abundant native help ever increasing in quantity and efficiency, and the annual 2,000,000 bales of cotton produced in Georgia, will all combine to continue mill building. Everything is at hand, ready for a great onward movement for the industrial, agricultural, and commercial upbuilding of our State and the South, except a profitable market for our surplus products. The revision of the tariff with its mystifying uncertainty, which has, for so many months, played an important part in continuing depression throughout the whole Country, now bids fair of an early settlement, and in so far as the cotton schedules are concerned, is in harmony with the best interests of the South. But the fostering and upbuilding of the markets within the borders of the United States is not sufficient. We already manufacture cotton goods far in excess of the demands of the domestic trade, so if we continue to

DR. JEFF DAVIS.

grow in usefulness and prosperity, foreign markets must be secured for our surplus products.

Some definite action by our Government at Washington, which will enable us to carry our products into the markets of the world, in open and successful competition with foreign manufacturers, is a condition most needed.

Georgia and the South constitute a section most in need of this Government aid. The Southern people would be most benefited by such a step, and yet strange, passing strange, is the fact that every measure of this kind introduced into Congress has been defeated by Southern congressmen and Southern senators. In this there is no conflict of classes; industrial development brings agricultural advantages. Around every manufacturing plant, large or small, the farmers and others enjoy the fruits of its prosperity. No purely agricultural people ever grew rich or powerful, and yet this is what the studied policy of foreign manufacturers and some of our Southern representatives would make of us. They would carry us back to the very recent times when we sold all of our cotton in the raw and bought all of our cotton goods. Then the only money crop was cotton, sold to the foreigner at starvation prices. The cotton mills, more than all other industries

combined, have not only raised the price of cotton, but they have, through their large cash payrolls, furnished home markets for everything that a prosperous Georgia farmer has to sell.

In our efforts to reach foreign markets in competition with manufacturers who employ the cheap pauper labor of Europe, Japan, and China, there should be no backward step in the earning capacity of our help, but relying upon the superior class of our employees, we should encourage individual and personal interests in the work to be accomplished, and aid in technical knowledge and industrial training.

The invention and use of labor-saving devices should receive our ready support, thus making it possible for one man to do the work of many.

There are many features of the cotton mill business which each manager must work out for himself and his plant, but there are others which require the combined efforts of all. Your success in the past has sufficiently proved your ability to cope with such questions as the former. In most cases, however, a more thorough technical knowledge of your mill and a firmer grasp upon the selling end would greatly strengthen your position.

A few mill men in Georgia have seen fit to hold themselves aloof from this Association, refusing to bear any part of its burdens. Its benefits, however, they can not refuse, as its work is not alone for its members, but for the improvement of all classes, and the industrial upbuilding of the whole State.

With a loosening of the ties of union in the Association must come that decadence with which we have lately been so sorely threatened. To be effective, there must be no hesitation in the enforcement of any and all agreements, and every mill must stand ready to respond to the call of the Executive Committee. In many matters this Committee should act only in concert with the governing boards of all other Southern cotton mill states. With this compact and efficient Organization holding the sympathy and confidence of the mills, many such losses as we had in the past year can easily be avoided and turned into substantial dividends.

THE CARD ROOM; THE SOUL OF THE MILL.

By Robert Wilson, Eagle & Phenix Mills, Columbus, Ga.

Primarily, too much care can not be taken in the mixing of the cotton itself. Experience has taught me that the best work has been secured when cotton, sufficient to run in the mill for at least one week, is mixed at one time. A large mixing is preferable from every standpoint. In a colored mill, it gives evenness in color; in a white mill, evenness in grade and shade. These advantages can never be gained by mixing in a small way. The object of mixing cotton is not simply to mix the different staples of cotton, but also to blend the shade to make it uniform and to open it to the air to give the cotton itself a chance to expand in order to get all the advantages incident thereto.

A number of mills are seriously handicapped for want of sufficient mixing space, and in some cases the bale breaker is actually used for this purpose, which delivers the cotton to the feeder. This method opens the cotton, but does not age it nor give it a chance to expand. However, this is better than using the cotton direct from the bale.

A number of years ago the cry came for double roving and double draft, and then the carders' and the spinners' real troubles began. With our new drawing frames the cry came for 6 doublings and 6 draft. To-day we see in many mill doublings galore. In fact, some are proud of 100,000 or more, having four processes of picking and three of drawing. Is it a wonder that the sliver on the third drawing has to have springs in the cans to hold it up in its real weakness? No, it is not a wonder, for the poor little inch has been drawn out 216 times. It is smooth, even and slick, and looks to the eye beautiful. But its beauty is only a glamor, for its weakness destroys all of of the revolving top flat card, a number of us thought that carding would then reach perfection, both in quality and quantity. Yet to-day you will see and hear of numbers of mills which are either putting in double carding or talking of doing so, on the revolving top flat card.

Referring once more to doublings: The evenest and strongest sliver I ever saw came from a drawing frame which had two doublings and a draft of two. It was almost perfect. So if two doublings make good work, why is it necessary to use six, and draw the entire or most of the life out of the cotton?

I may be wrong, but I am earnestly of the opinion that we are doubling and drafting too much. The time-honored saying that "Doubling without twist does not count much," is a very true one. Try less doubling and less draft and note results. In any event, nothing could commend your earnest time and attention with better hope of result than serious thought about doublings and drafts.

To summarize: (1) The overseer in charge of the carding and picking department should be as competent as the best man employed in your mill.

(2) I should advise, either for a white mill or for a colored mill, mixing sufficient cotton for not less than one week's supply.

(3) For a mill making grey goods, I should certainly advise the non-use of pin grids or carding beaters on account of diffusing the motes into nits, which are very difficult to get rid of.

(4) In your lappers, as in all operation in the picker or card room, I should advise having help capable and competent enough to see that this lap is always clean and even.

(5) In carding, the commonest error is trying to get too much work off the machine. Naturally, the amount to be worked off your card is regulated by the character of work a mill is engaged in; but for the usual numbers of 12s to 16s yarn, applicable to most of the Southern mills, I should never advise producing over 185 pounds per card per day.

(6) I can not emphasize too strongly that the usual mistake in doubling and drafting is that most people have decidedly too much. Experience has taught me that work of admirable character is accomplished with very much less doubling and draft than we are advised by machine builders to use. For instance: In Kimono outings, in which the mill by whom I am employed is most largely engaged, and which goods have a national reputation, we find it easy to produce a cloth that commends itself to critical buyers. In its construction, the doublings in the warp and filling, from the card to the cloth, are only 12.

It is a mathematical fact, easily ascertained, that the reduction of the doublings will increase the production. So the only thing to be certain about is that they are not reduced beyond the place where acceptable cloth is produced.

MEETING OF SOUTH CAROLINA COTTON MANUFACTURERS' ASSOCIATION.

The Association met at Glenn Springs, S. C., on Saturday, June 12. Among those who addressed the meeting were Harvie Jordan who spoke on the "Better Baling and Handling of American Cotton." Augustus W. Smith read a paper on the same subject. E. H. Rooney discussed "Carding and Spinning of Waste Products."

President E. A. Smythe, in his address, recommended, among others matters of interest to the manufacturers of the State, mutual fire insurance for the mill men to work in harmony with the New England Mutual Fire Insurance Companies. The question was referred to the executive committee with power to appoint a committee to organize a mutual fire insurance company if they could see their way clear to do so.

Lewis Parker introduced a resolution recommending that the mills of the South Carolina Cotton Manufacturers' Association use electric power as far as possible on account of the heavy freight rates on coal. From the discussion that followed it would appear that the cotton manufacturers are not satisfied with the freight rates imposed by the railroads.

E. H. Rooney, of the Whitin Machine Works, in his paper, showed the economies to be effected in proper use of mill wastes. He stated that enough material is wasted each year to make the manufacturers rich, if properly used.

The South Carolina Cotton Manufacturers' Association represents 3,250,000 spindles. One hundred and nine mills are in the organization, and of that number sixty-four were represented at the annual meeting.

The following officers were elected: President, E. A. Smythe, Pelzer; vice-president, V. M. Montgomery, Spartanburg; treasurer, J. A. Brock, Anderson; secretary, Thos. I. Charles, Greenville; executive committee, J. M. Geer, Easley; W. P. Ruff, Lexington; J. David Woodside, Greenville; E. Nicholson, Union; C. C. Twitty, Hartsville, and A. F. McKissick, Greenwood.

DECREASED CONSUMPTION IN CHINA OF FOREIGN SPUN COTTON YARNS.

The decreased importation of cotton yarn into China is due largely to the marked expansion of the spinning industry within its own borders. The total number of spindles in operation in China at the end of January, 1908, was 744,824, compared with 350,000 only six months previously. At the present time there are 27 spinning mills in China, producing an annual output of yarn estimated at 400,000 bales. A further increase of about 20,000 spindles will be made in the near future. Of the existing 27 spinning mills in China, 13 are located in Shanghai where the annual output of yarn exceeds 260,000 bales. There is one mill located in Honkong and one in Tientsin, while the remaining twelve mills are distributed in the vicinity of Shanghai and the Yangtze Valley. These latter mills are now concentrating their energies on the production of the variety of coarse yarns such as were largely imported from Japan. The quality of Chinese yarn has greatly improved with the increased number of spindles in operation, and the price is now 58.8 cents lower than the imported Japanese yarn. The Chinese mills enjoy a great advantage by using Chinese raw cotton, the price of which is in no way affected by fluctuations in the silver market of the country.—*Consular Report.*

THE AIM OF THE TEXTILE SCHOOL.

(EXTRACT FROM ADDRESS TO THE PHILADELPHIA TEXTILE SCHOOL.)

BY CHARLES BUTTERWORTH.

Textile education, to begin with, is not a product of the nineteenth century great as has been its strides during the last hundred, or even fifty years. Ever since the industry was placed upon a firm commercial foundation progressive spirits have endeavored to impart to the worker in his chosen field advice and assistance looking toward the promotion of his efforts.

Schools of this character, although very crude at best, and limited in appointment, were well known to the ancients. The martial Romans are recorded as having encouraged the trades of spinning. With the Dark Ages of the Christian era the art and crafts of textiles declined, but, fortunately, were fostered by communities of Europe not drawn into the glare of conquest, and who, therefore, kept alive the spark of industrial flame which so spread itself with the dawn of the Renaissance. Historical data is at hand to show that the politically ambitious Emperor Charlemagne had extensive spinning schools upon his vast estates for systematic instruction, appreciating, as he did, the ultimate value to his domains of such training for industrial advancement.

But it was not until about 100 year ago that real textile education, upon an organized plan, was attempted. The credit for this belongs to France, who in 1810, first established a department for spinning, weaving and dyeing in the School of Arts and Crafts, in Paris. Other commercial centers of the Old World were soon to realize the advantages of this movement, and at short intervals the rest of the European nations, either as state-subsidized institutions or as private establishments, were at work along the same line for national industrial developmtnt. In England, in Germany, in Italy, in Austria and in the lesser States of Europe—and not omitting France herself—are now found these technical schools for the manipulation of wool, of cotton, of silk and of flax, which are the very bulwarks of one of the greatest industries on earth. America is behind only in slowness of inauguration of the system, not in ambition. The plan, in the direction of home efforts, after surmounting many difficulties, was at last put in operation and our own school was the pioneer in this movement, being established in the year 1884.

The purpose of a textile school is not always correctly understood by the lay public. Textile manufacturers there are, too, who, not in close touch with educational affairs, are not fully aware of just what a school of this character has to offer in the way of technical information. It is a mistake for any one to suppose that every detail of process or procedure that goes to make up the life of a busy practical mill or mercantile man can be comprehended within the comparatively brief space of three years. The popular notion, erroneous as it is, would appear to be that a three years' attendance should make a neophyte a veritable paragon of textile learning.

Textile knowledge can not be bought. The acceptance of a tuition fee by the institution, which is infinitesimally small compared with value given, does not signify that instruction can be forced upon the martriculate, or that it can be poured into a dilatory candidate by the way of the head. The opportunities for the studious are there;

they can be assimilated, and the curriculum is so arranged that it will in no way cause mental indigestion, but the instruction can not be administered hypodermically. It rests finally with the student himself what he can or can not get from a systematic course of technical instruction offered.

A textile school occupies the advantageous position of being a clearing house of the information, so to speak. With its staff of instructors being appealed to constantly for expert opinions, the institution is thus able, from a commercially practical point of view, to keep fully abreast of the times, and to impart, in substance, by hypothetical examples, to the student body the benefits of such outside consultation.

Some well-meaning folks have advocated strongly for making of the school a veritable workshop. The nature of a textile school, with its careful methods of imparting information from the fundamental to the most advanced character, and the comparative inexperience in the way of labor of its students, precludes the turning of the institution into a mill, running through hundred-pound lots of cotton, wool, or silk daily. Furthermore, it is not, and should not be, appointed to conduct such commercial enterprise. To so equip a school with sets of machinery to equalize production on a business basis would defeat its own purpose, and it would soon become either a poor mill or an inefficient school, or both. The query might not be out of place, who would be willing to take over the productive output? So, those who criticise the textile school's policy of putting less emphasis on the practical side than on the technical would probably appreciate the distinction that parents do not send their boys to West Point to engage in actual warfare, but to fit them with a theoretical fund of information for the proper and intelligent discharge of their future duties.

TEXTILE EXHIBITORS' ASSOCIATION.

The following general letter has been sent out by the secretary, Chester I. Campbell, from the office of the association in Boston—An invitation was recently extended to you to attend a meeting to discuss the late show and to consider the course to be taken for future exhibitions. This meeting was held and both members of the association and others who exhibited at the last show were well represented.

You may be interested to know that the receipts of the late show enabled the association to pay a dividend in the form of a rebate to the exhibiting members of the Textile Exhibitors Association of an amount equal to 40 per cent. of the price paid by them for space. We all regret that all exhibitors did not avail themselves of the privilege of joining the association and thus being entitled to participate in the "Cutting of the Melon." The invitation is extended to all again—so if you are not a member—the entrance fee is $10 and annual dues $10. Send the $20 and be a member.

The unanimous opinion of all present was in favor of another show in 1910—we want to consolidate all the industries bearing on the mechanical and finished product field in a great exposition—the cotton, woolen, knit goods, hosiery and all products they represent—you can assist.

We want you to criticise the last show, and suggest such improvements as you may have noted that needed attention. Let us hear from you at your earliest convenience that the Executive Committee may take such action as may be deemed wise.

COTTON CULTURE IN EGYPT.

INCREASE IN ACREAGE IS OFFSET BY A REDUCTION IN YIELD PER ACRE. UNFAVORABLE CONDITIONS DUE TO CLIMATE, IRRIGATION AND OVER-CROPPING. FERTILIZERS, ROTATION OF CROPS AND SEED SELECTION ARE SUGGESTED. PROBLEM OF DRAINAGE AN IMPORTANT ONE, BUT COSTLY. A MAXIMUM AVERAGE YIELD ESTIMATED AT 382 POUNDS PER ACRE.

The French Ministry of Agriculture has recently published some interesting facts in regard to Egyptian cotton growing furnished by the charge d'affaires of France in Egypt.

This officer refers to it as an established fact that notwithstanding a progressive increase in the area devoted to cotton in Egypt, there is on the whole no increase in the quantity produced, the increase in acreage being about offset by a reduction in the yield per acre.

As cotton is the only important article produced for exportation this condition of affairs is viewed with anxiety, and a commission to inquire into its causes has been appointed by the Anglo-Egyptian Government. After considerable discussion, the commission is said to have agreed that the causes of the unfavorable condition of affairs were to be found in climatic influences, in irrigation, and in overproduction, and that each of these three points should be studied in detail by a subcommission specially designated for the purpose.

Attention has been called to the fact that it has not in general been the custom in Egypt to grow two crops of cotton on the same land without leaving a considerable interval between the crops. But when cultivators as careless of the morrow as the Egyptian fellaheen saw the prices of cotton rising they planted it first once in four years, then once in three, and finally, in many cases, every other year. This was requiring of the land more than it could give, even were it all as rich as the Nile Delta; and it is such overcropping rather than overproduction in the usual sense of that expression that is a leading cause of decreased yields. The evil might, to some extent, have been held in check if the fellaheen had been shown the error of their course by intelligent and careful landowners; but Egypt, it is pointed out, suffers as do few other countries from the plague of absenteeism, the proprietors of large estates leaving their property under the management of indolent and incompetent agents, while capitalists who have invested in land with a view to selling it out in smaller tracts take little interest in improving or even maintaining the condition of land that is soon to pass out of their hands. The opinion is expressed that by the use of commercial fertilizers and selected seed, with a triennial rotation of crops, the evil in question might, in so far as it results from overcropping, quite easily be combated.

The question of irrigation is more complicated. It is admitted that the wealth of Egypt has been considerably increased by the magnificent work of the great dams or barrages on the Nile, which have enlarged the area and increased the frequency of cultivation. But while the substitution of perennial irrigation for the temporary inundations of former times permits the precious liquid, indispensable to Egypt, to be kept in reserve in immense basins, it is not without some drawbacks. When the water of the Nile, instead of circulating in narrow canals, which serve

as the arteries of vast oases, covered the entire country for a time and then slowly retired, it performed the double service of depositing a fertilizing mud upon the fields and carrying off with it in solution a saline efflorescence injurious to crops, which tends to accumulate on the lands of the Delta, won in the course of ages from the marine sands. Now that the Nile is brought under control, its mud is deposited at the bottom of the canals, which require continued cleaning out, and the saline efflorescence reappears on the surface of the fields.

Here again a remedy has been pointed out, namely, drainage, which has, in fact, been more or less practiced by the natives for a long time; but its wider application is daily becoming more and more necessary. The drainage canals called "masrafs," which now carry off the water holding in solution the salt referred to, are far from being equally and rationally distributed through the interior of the country, and the engineers have now to face the problem of a drainage system as comprehensive as the system of irrigation that has been established. Such a system would afford a certain remedy; but the undertaking would be a formidable and very costly one.

There is, however, another phase of the water problem in which the cotton grower is more directly and deeply concerned than he is in the freeing of the lands from saline incrustations, which are, in fact, less injurious to the cotton plant than they are to the cereals. To keep this plant at its best, it is frequent moderate applications of water, rather than infrequent and abundant ones, that are needed. For example, a little water once in ten days does it much more good than a great deal once in twenty days. But as the irrigation service has to take into account the needs of all the irrigated crops, it is not always able to supply water for the cotton fields at the time or in the proportions needed. Whenever it fails to do this, the growth of the plant is, of course, unfavorably affected; and it is not every one who can make himself independent of the irrigation service by digging an artesian well 170 feet deep and utilizing the water thus obtained by means of an 80-horsepower pump, as was done by a director of the Credit Foncier on a great estate near Zagazig, at a cost of $57,900.

It is stated incidentally that in many districts the natives are beginning to complain that they are deprived of water just when it would be most beneficial to their chief bread crop.

The last point touched upon in connection with the failure of the cotton crop to increase with the increase in its area is the influence of climate and the modifications in the latter traceable to the new irrigation works. It is pointed out by the French charge d'affaires that perennial irrigation has the effect of retaining on the general surface of Egypt an increased quantity of water. Hence results a latent humidity which in the subsoil is more or less favorable to the roots of the cotton plant, while in the atmosphere it tends to the formation of fogs. These are said to be injurious to the seed of the cotton plant, not so much, perhaps, through their own direct effects as through their intercepting of the solar heat and retarding the ripening, thus delaying that process beyond its normal period, and causing it to take place under adverse conditions.

Minor causes, such as the damage done by the cotton worm, lack of animals for adequate tillage, and rudimentary implements and processes, are referred to as not altogether negligible; but the fundamental difficulty, according to the authorities above cited, is in the general agronomic situation itself. This situation, it is conceded, is modifiable at many points; but the opinion is expressed that the most resolute optimist can not hope to see the yields of cotton raised above their present average of about 382 pounds per acre; and even to maintain this average will require careful and rational methods of culture and new expenditures for hydraulic works and fertilizers.

INFLUENCE OF LONG DISTANCE POWER TRANSMISSION ON THE TEXTILE INDUSTRY.

(*Contributed expressly to* COTTON.)

AN ELECTRIC DRIVE FROM AN OPERATING POINT OF VIEW IS DESIRABLE. THE APPLICATION OF WATER POWER. UTILIZATION OF NIAGARA FALLS. A THREE-HUNDRED MILE LINE IN ONTARIO.

BY C. L. DE MURALT.

A Member of the Firm of Murat & Co., Engineers, New York. Professor of Electrical Engineering, University of Michigan.

The numerous advantages afforded by the application of electric drive to textile mill machinery has gained steadily in recognition since its inception, until at the present time its desirability, from an operating point of view at least, is unquestioned.

While the employment of electric power is therefore highly advisable in most cases, financial considerations often render its use impossible. The cost of motors and driving equipment is small. But, in localities where commercial electric power can not be purchased on favorable terms, the investment necessary for generating apparatus may make the advisability of a change in motive power doubtful. Furthermore, where electricity is generated by steam, the high operating cost may again prohibit the use of electric power.

Where water-power is available, even though it may not be controlled directly by the mill operators, it is usually practicable to use electricity. The production of electric power from this source is generally so low that even commercial power companies can afford to sell their output at very reasonable prices. When the water-power is owned by the mill owners, the advantages of electric drive are still more marked.

The water power is in most cases not at all favorably located for efficient mechanical transmission of power to the mill buildings. In any event the cost of such transmission equipment would be heavy, the more so, the further the mill is from the power site.

The most avaliable water-powers have already been utilized. The nearest remaining water-power may therefore be miles away. Even though an abundance of power may be secured at merely the development expenses, it may be so inaccessibly located as to preclude the possibility of locating new mills or moving old ones to its vicinity. This is almost always the case with mountain water-powers, where the shipping in of the raw material or shipping out of the finished product would be out of the question. Were this water-power avaliable in a favorable place, no doubt a center of the industry might eventually be developed in its vicinity, as has often been evidenced in the growth of many New England towns where the textile industry has flourished.

Practically the same conditions can be brought about, even with water-power situated as much as 100 miles

from a center of utilization, through the great strides which have recently been made in electrical power transmission at high voltages. The transmission of power was not attempted over any distance until the use of alternating current was initiated for transmission purposes. From that time greater and greater distances have been spanned by the use of higher and higher electrical pressures, until the high water-mark for both distance of transmission and pressure employed has been reached in the 110,000 volts, 300 mile line now being erected by the Hydro-Electric Power Commission of Ontario.

With the relation which electrical transmission necessarily must bear to the textile industry, in view of the wide spread use of electrical drive in textile mills, this convincing illustration of the possibilities of transmission of power over long distances, should prove of interest.

This power transmission line is being erected by the Hydro-Electric Power Commission appointed by the Provincial Government of Ontario, and has for its purpose the delivery of the power developed at Niagara Falls to the principal cities of the Province of Ontario. The actual work of erection is being carried out by the Niagara & Ontario Construction Co., Ltd., under the direction of Muralt & Co., engineers, of New York City.

The general outline of the territority to be supplied by this power line is shown in Fig. I. The power is generated in the hydro-electric plant of the Ontario Power Co., situated on the Canadian side of the Niagra River just below the falls. Three-phase current is generated at 12,000 volts and 25 cycles, and will be stepped-up by suitable transformers to a line pressure of 110,000 volts. The present line is designed to transmit about 40,000 H. P. to the various cities of the Province.

From the generating station at Niagara Falls, the line runs 50 miles northwesterly to Dundas where the main inter-switching is located. At this point the line divides, one branch running around Lake Ontario about 40 miles to Toronto, while the other two branches go westerly to London.

The northen branch extends some 120 miles through the cities of Guelph, Berlin and Stratford, while the southern branch takes a more direct route through Woodstock and Brantford to London, a distance of about 75 miles. From London there is a 14 mile extension to St. Thomas. It has already been decided to eventually extend this line over 100 miles to Windsor and Walkerville, situated on the Detroit River opposite Detroit.

The possibility of transmission of electrical power over long distances depends directly upon the magnitude of the electrical pressure which can be used. This is largely a question of properly insulating the line for such high voltages.

In underground cables the insulation consists of rubber or paper or similar materials. Such cables, however, can safely withstand only about 20,000 to 30,000 volts. Hence, for long distance transmission lines, bare wire is used strung in the air and insulated only at the points of support, The great problem, therefore, has been the development of a suitable glass or porcelain insulator to safely insulate the wire from its support.

In Fig. 2 is shown at the right hand side, the style of insulator heretofore used for pressures up to 60,000 volts. But, even when these are made up of several parts cemented together, they are large and costly, being often two or three feet in diameter and of great height.

For this reason the disc of suspension type insulator, shown also in Fig. 2 has been developed. This form of insulator is made up of porcelain discs linked together, the line conductor being fastened at the lowest point. Each disc is in itself an insulator good for 25,000 volts, so that the aggregate presure which the five together can withstand is 125,000 volts which provides amply for the voltage used in this case.

For a power line of this size and importance, steel poles only should be considered. They afford more permanence, longer spans and hence fewer points of insulation.

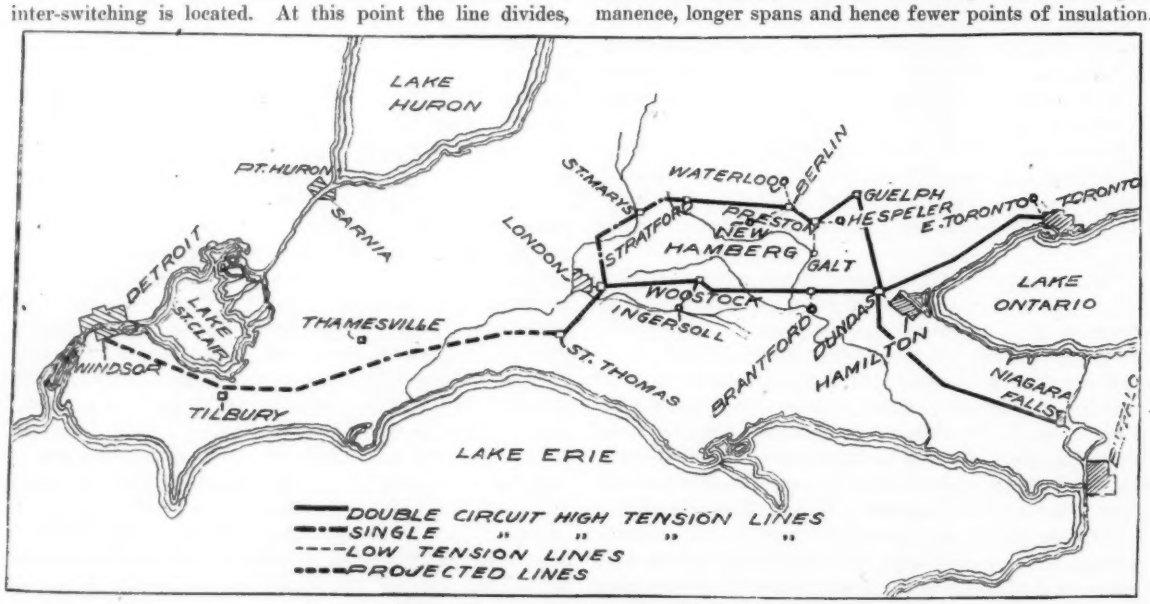


FIG. 1. TERRITORY TO BE SUPPLIED WITH ELECTRICITY.

The general appearance of these steel poles is shown at the left in Fig. 2. They are constructed in the form of galvanized angle iron towers, similar to windmill towers, and placed on frame steel anchorages set in concrete to a depth of about six feet below ground level. The height

will vary according to local conditions, 65 feet being the normal height above the ground.

The minimum clearance between the conductors and the ground will be 22 feet. At the point where the line crosses the Welland Canal extra high towers will be used, as a clearance of 150 feet is required to permit the passage of vessels.

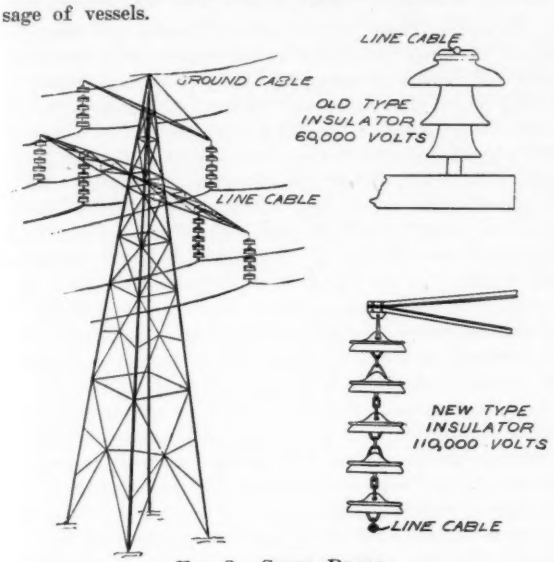


FIG. 2. STEEL POLES.

In level or rolling country, the towers will be spaced about 550 feet apart on the straight stretches, and on curves not less than 100 feet. The maximum spans occur at river crossings, the length which spans the Humber River being of 1250 feet. Where the line crosses the railroads and other transmission lines, special types of towers will also be required.

The conductors themselves will be of stranded aluminum cable, having a cross-section equivalent to No. 000 B. & S. gage, except on the line from Niagara Falls to Dundas where a cross-section equal to No. 0000 B. & S. gauge will be used.

Aluminum was decided upon for the conduction material because it was both cheaper and stronger.

For equal conductivity, aluminum in this instance was 5 per cent. cheaper than copper, and although having a 60 per cent. larger cross-sectional area, will weigh only 48 per cent. as much as copper.

A concrete idea of the extent of this line may be gained from the statement that about 100,000 pounds of aluminum cable and over 7500 tons of steel, distributed in some 3200 towers, will be utilized in its erection.

An iron ground cable extends over the highest point of each tower to protect the line from lightning disturbances.

TEXTILE EDUCATION IN TEXAS.

The school of textile engineering established in 1904 as one of the departments of the Agricultural and Mechanical College of Texas, College Station, Texas, and which sent out three graduates in 1906, now has 12 students, one of whom will be graduated this year. The textile school is under the direction of J. B. Bagley, a mill man of North Carolina, and C. S. Tatum, a graduate of the Georgia School of Technology. A course of instruction in cotton grading has been established in the school.

WHY TARIFF ON HOSIERY SHOULD BE INCREASED.

The National Association of Hosiery and Underwear Manufacturers are presenting in widely distributed circulars the following answers to the arguments of the importers of foreign hosiery. The importers maintain that the Dingley rates as now existing afford ample protection to the American knitting industry; these arguments are self evident from the replies made.

The sole request of the American manufacturers is for a measure of protection much lower than contemplated by the framers of the Dingley schedule, who never foresaw the collapse in foreign hosiery prices of the last eighteen months. This condition is aggravated in the landing price by a drop to the low tariff classification never dreamed of when the Dingley bill was framed. The following shows the importations at the port of New York for January, February, March, 1909:

	Dozens.	Value.	Average cost doz.
1908	997,474	$1,590,453	$1,59½
1909	1,072,852	1,294,670	1.20⅝

The reduction in average price, per dozen of 39⅞ cents in Germany means, with the difference in duty, a reduction in the landing price of 50 to 67 cents per dozen, according to classification, to offset which the Payne bill grants but a partial equivalent.

It has been stated that this collapse is due to the panic. The panic brought to a focus conditions which have been maturing for eight years, but which were staved off by the "boom" which enabled the German manufacturers to reap the entire benefit of cheapened cost of production, because there was a greater demand than supply at the old prices. When the demand stopped there came a fall in six months that should otherwise have come gradually in the eight years before. There was also a sharp reduction in wages. The prices that are now current in Germany are the logical outcome of normal conditions uninfluenced by either boom or panic. They have come to stay within narrow fluctuations.

When "so-called full-fashioned goods" are landed cheaper than the so-called "seamless," they compete even more seriously with these than with the American full-fashioned. It is not especially upon the cheap class of goods that a fair measure of protection is asked, but upon those which American mills are fitted to make, if adequately protected.

During the recent boom yarns and other items of cost and also labor advanced sharply and yet the retail price of the domestic twenty-five-cent stocking could not be advanced. The increased cost was divided between the manufacturer, the jobber and the retailer. The same will happen to the importer and the retailer when the foreign stocking costs one and two-thirds cents per pair more to land.

The American hosiery manufacturers claim that their industry is languishing *now*, owing to new conditions that have come within the last eighteen months. They do not claim that their industry *did* languish during the years preceding 1908. The Payne schedule concerns itself with the present and with the future, and not with the past. It aims to meet new conditions with a new remedy. Had German hosiery remained at the prices antedating 1908, no American manufacturer would have asked for the increase.

The growth of the domestic hosiery industry from 1900 to 1908 shows the beneficent effect of adequate protection.

This protection has ceased to be adequate within the past eighteen months. During the past decade the consumer has fared better and better. The prices of domestic seamless hosiery have been cut in half during the past twenty years, in the face of nearly double the price of cotton, a largely increased cost of other items and a very large advance in the wage scale. This result has been made possible by improvements in machinery, and by the economies of enlarged output developed under a system of *adequate* protection, *now no longer adequate*. There has been no grosser misstatement than that circulated in the press that "the price of hosiery has been going up by leaps and bounds."

It is not true that certain mills are closed on account of a change in fashion. It so happens that some of the mills that are closed or running on part time *did* make goods *now* out of fashion, but they are equipped to make goods that would be in active demand but for ruinous foreign competition, and they would at once run on full time under the Payne tariff.

Embroidered hosiery is *not* out of style. As to the temporary neglect of Jacquards, the mills equipped to make these can just as well make "two toned" and solid effects, which would find a ready market, but for the disastrous foreign competition. But, as a matter of fact, not only the full-fashioned industry, but the makers of all seamless goods made to retail above 15 cents per pair were saved from complete annihilation only by the sudden vogue of mercerized fabrics, which foreigners could not at once supply in sufficient quantities. A change in this situation or a return to "lisle finish" (both already talked of) would aggravate the present disastrous condition ten-fold.

The panic *did* force some mills to suspend operations, but the panic is over, and general business conditions are such that the mills now idle could be run on full time did not the German manufacturers have the advantage of 20 cents per dozen in the cost of production under the Dingley rates. If the idleness of American mills is due to general stagnation and not to insufficient protection, why are importations larger than ever as is shown by the importation figures quoted above?

The Association claims that the Wayne Knitting Mills, of Ft. Wayne, Indiana, prefer the Dingley rates on hosiery to the Payne schedule because they desire to reduce wages and they get by declaring against the Payne schedule a colossal amount of free advertising such as a fortune would not buy.

If the leading knitting manufacturers are behind in their deliveries it is due to two factors:

First. In normal times customers anticipated their wants. Of late they have operated from hand to mouth. Mills can not turn out in three months what requires six months to manufacture.

Second. A reduced capacity consequent to a disorganization caused by insufficient business can not be repaired temporarily or at once. As a matter of fact, the majority of the leading hosiery manufacturers are not working their plants to their full capacity, and a great proportion of the goods being made to-day are for stock.

Inquiries about anything pertaining to the textile industries will be cheerfully answered by COTTON.

COTTON is the leading textile paper in the South.

WATER SUPPLY FROM WELLS FOR TEXTILE MILLS.

(*Contributed exclusively to* COTTON.)

BY JOS. H. HART, PH.D.

In almost every manufacturing process, an adequate supply of water available at a minimum cost is becoming more and more a necessity for the most efficient operation of the plant. The utilization of water in textile mills for different purposes is becoming more and more extensive and a great majority of factories to-day consider the problem of water supply as one of prime importance. As a simple illustration of this, we know that water is an absolute necessity in the production of steam-power in large quantities and the use of condensers, while increasing the efficiency of the engine, also means an increased consumption of water for condenser work. In addition to its use in the development of power, a large quantity of water is required on account of the use of steam and water for heating and drying purposes.

Dye houses and bleacheries require an enormous amount of water and the lack of proper water supply in certain localities has prevented and practically made impossible the establishment of such plants in those sections.

Again, water must be used or at least be on hand for a number of purposes other than the operation of the mill if best efficiency of the work and economy in fixed charges are to be maintained. As an illustration of this, the item of insurance alone need be considered. Insurance of property is to-day an absolute necessity. Insurance rates are very high in the textile industry, and various sprinkling devices have been installed to eliminate the danger of fire, and thus secure the advantage of rates for that class of insurance. The sprinkler risk carries a much lower rate of insurance than the ordinary type, and the difference in cost is often sufficient to pay for the system in a few years. Automatic sprinklers require a definite supply of water to be on hand in a tower at all times and this represents an additional demand for water, not for continuous use, but at least for its presence. It also involves a small additional supply from time to time, due to waste and evaporation.

Sufficient uses have been mentioned to show that in this industry, a large supply of water is constantly required in all mills, and some of them require more than others. It is also necessary that this water be of a satisfactory character. This water, of course, can be obtained from a number of sources, but the situation has developed to such an extent that the maintenance of many mills in an efficient and profitable condition is dependent in a great measure upon the economy in cost and availability of an adequate supply of water.

Assuming that there is a demand for an adequate supply of water in a mill, the various sources from which this can be obtained can now be considered. If the plant is in a large city, the city supply is readily available, but at prices which make its utilization in large quantities rather burdensome. It goes without saying that a small pumping plant can be operated more cheaply than water can be furnished from even large plants of this type, and this is especially the case if an excess of power is at hand for other purposes, in sufficient quantities for its utilization in this field, without the installation of complete equipment. Under these circumstances it would be advisable to install

a complete pumping equipment, if only a source of water supply can be obtained. Local conditions and the price of water give a decision in this field entirely. Now water can be obtained from several sources. The most satisfactory condition is when a lake or river is close at hand, and from which water can be readily pumped to the mill. The demand for water in large quantities has been so great and the supply is so essential for large mills that the location of such a plant near an available water supply is becoming almost a necessity for satisfactory operation in this field. In selecting a site for a new mill, the water problem should be carefully considered. Often in large cities, even where lakes and rivers are within convenient operating distance of such a plant, the utilization of the water is often prohibited, first, by the nature of the water, and second, by rights-of-way often held by railway or other plants which will often prove an absolute barrier to its use.

Under these circumstances, obtaining water from wells is the only recourse. It is a fact, however, that sinking a well for an adequate supply of water, is somewhat of an uncertainty. Wells are of such a character, that sometimes two wells within 10 feet of each other may have a difference in output extending from an adequate supply for a mill, on the one hand, to absolutely no supply on the other. From this we see that it is necessary for wells to be sunk in a scientific manner, and with the greatest possibility of obtaining water. The ordinary dictum of engineers is that it seldom pays to go below 1,500 feet for water, and this is not only true for textile mills, but we could go further and say that this may be cut down greatly. Not only is there remote probability of obtaining water at great depth, but the character of the water whenever obtained at a great depth is generally such as to preclude its use, especially for utilization in a boiler. Water for boiler purposes should be fairly pure, and not impregnated with mineral salts, as the latter are deposited as scale on the boiler tubes, when they crystallize from the water in the making of steam, and are a source of much trouble, expense and inefficiently of the boiler. However, it almost invariably pays manufacturers who use water for other than boiler purposes to sink wells and use their own pumping equipment.

In the obtaining of an adequate supply of water from wells, a certain procedure should be followed in the system of exploration. Single wells should be sunk to a moderate depth. By a moderate depth is meant the ordinary service well, from 25 to 50 feet deep. If water is obtained at that depth the supply should be at once measured. The output of the well is absolutely dependent upon certain conditions. As the water is pumped from the well, the surface of the water in the well goes lower. This sinking of the water level is technically known as the recession of the well, and the supply of water available from the well is dependent upon this recession within wide limits. Water comes into the well by draining the surrounding territory. If the recession is great, a much larger territory is drained, and also the gradiant flow is increased with a similiar resultant increase in the supply in the well. Thus, the well should be tested for available water supply by recession almost to the bottom of the well. If the supply is found to be inadequate, the choice of two procedures is then possible. Either another well can be sunk or the first one can be made deeper and the recession then can be carried a little deeper in the well. Both procedures possess various advantages, but neither one can claim to be the better. Single wells sunk deeper mean a larger lift of the water, and therefore, a greater power consumption and the necessity for a larger and stronger equipment. The development of two wells on the other hand, means in some cases, the substitution of two pumping machines, although it is not a necessity and depends upon the character of the water supply.

This brings us to the subject of pumps. Many large factories have been compelled to sink as many as a dozen or more wells to get a satisfactory supply of water. This is especially the case in plants where a large supply of water is absolutely necessary, and the adequacy of the supply from this source it not definite. Many water-works have as many as 20 wells in operation, and the same may be said of many large manufacturing plants. The kind of installation of pumping machinery in this case became a matter for much consideration, as such a large well equipment is unusual and requirements seldom demand more than four or five wells. Wells are divided into two types, depending upon the nature of the pumps required for their use. These pumps are known as the ordinary service pump and the deep well pump.

Ordinary Service pumps are generally horizontal in their motion and consist of a pump cylinder and piston directly connected to a corresponding steam cylinder and piston. These pumps are very general in their use, and are the cheapest to install. They are very effective in operation, and require comparatively little attention. However, they are limited in their use, in some cases by the nature of the available water supply. If the level of the water in the well falls 26 feet below the level of operation of the pump, the pump ceases to operate. In reality, they are suction pumps and are dependent upon the pressure of the atmosphere to force the water to the level of the pump cylinder. The height to which they can operate is dependent absolutely upon the strength of the pump and the steam pressure available. Such a pump possesses the advantage that it can pump from several wells at once. Pipes can be run from the main suction pipe into any number of wells and water can be pumped equally from all of them. The difficulty encountered in this pump in such an installation consists primarily in the possibility of the vacuum being broken in the pipes by recession of the water in one well below 26 foot level, whereupon the pump will cease to operate until suction has been re-established. In this installation, care must be taken in the operation of the pump to prevent too great recession, which is accomplished by means of valves in the pipes to regulate the flow.

The Deep Well pumps with steam heads, as they are technically called, often take the place of the ordinary service pump when the recession of the water in the well is such that the suction pipe fails to operate. The latter result may be accidental or caused by an extra tax on the well, in order to supply the adequate amount of water. A deep well pump consists generally of a single acting service pump, set up so as to act vertically. The pump cylinder is lowered to the bottom of the well, while the steam cylinder operates and is practically set directly over the well orifice. The piston connecting the steam cylinder and pump cylinder, generally consists of a long strand of steel wire or rods joined together, and the action is a lifting one entirely. The filling of the pump cylinder and the return of the piston to its lowest position is completed by gravity. Such pumps can operate to any depth, the

only requirement being to adjust the length of the piston to the required depth. Such deep well pumps require a separate pumping unit for each well, and when the number of wells is great and their depth considerable, the expense is proportionately large. However, this latter condition exists in comparatively few of the plants in operation in the Country to-day.

When the expense of using deep well pumps is excessive, a new type of pump may be used to advantage. It is known technically as the Air Lift system. The machinery consists of an air compressor for compressed air, and two pipes for the well. With this machine, the pumping of the water becomes a problem of minor significance and is easily accomplished. The pumping equipment under these circumstances, it simplicity itself. A water pipe is extended nearly to the bottom of the well, and is open at the lower end. A smaller pipe for the compressed air is placed in the well and is connected to the water-pipe below the surface of the water and near the bottom of the water-pipe. The compressed air from the machine is then forced down through the air pipe and into the water pipe near the bottom. The air rising from the bottom of the pipe acquires an upward momentum. Each bubble of air acts as a litlte piston in driving the water upward through the water pipe to the surface of the well and is very efficient in comparison to ordinary equipments.

The ordinary steam pump is a very great consumer of steam. There is no cut-off, in general, in the steam cylinder and the steam is carried throughout the stroke at the boiler pressure, and is then turned into exhaust. Given a supply of compressed air, the pumping of water becomes a minor problem, and this is the case even where a great number of wells are used. Such a system is much lower in cost and superior in operation to a number of deep well pumps, or service pumps.

Steam is sometimes used in this field in place of compressed air. This is especially the case in testing wells in regard to their capacity, but the process is extremely inefficient, and the use of steam is very objectionable for permanent work. A number of other pumps exist, being modifications of the air lift system. Such a pump uses comprssed air, which first drives a piston to start the water and then utilizes its own exhaust, and thus further assists the movement, but when first cost and cost of maintenance are considered, the simple Air Lift system is superior in the majority of cases.

The sinking of wells and installation of pumping machines, have become almost matters of prime importance for very many factories, and the necessity for their installation will steadily increase with time.

TEXTILE TRADE IN GERMANY.

In the textile trades in Germany there were 1,059,243 persons employed therein in 1907. This is about equal to the number of persons employed in these trades in England in 1904, the figures then being 1,026,378. The production, however, in Germany is far from being so great as in England, and the number of operatives there is no doubt due to their comparative inefficiency as textile workers, and to the fact that the machinery is not "speeded-up" to the degree it is in England. But it is evident that the German factory worker is getting more efficient. The percentage of persons—to the total of population—employed in textile mills is less than it was in 1882—it was the 5.25 and 4.29 in 1907. This is probably due to the changed methods of the industry. Since 1895 the tendency has been decidedly towards a greater concentration of German manufacturing and commercial enterprises. This has been particularly the case in respect to the cotton industry, many of the mills now being furnished and conducted on the most up-to-date principles.

INDUCED VS. NATURAL DRAFT.

(Contributed exclusively to COTTON.)

BY ALFRED BURTON.

Pure air which plays such an important part both in our physical and commercial economy is composed by weight of 77 part of nitrogen and 23 part of oxygen; 13 cubic feet of air at 60° F. weigh 1 pound. One pound of coal of medium quality contains about 75 parts of carbon, 5 parts of hydrogen, the remaining 20 per cent. being made up of other gases, moisture and ash, and if perfectly burned it will give off about 13,500 thermal units. However, as there are no two coals of the same composition it is found that the calorific values vary from 10 units of heat per pound to as high as 15,500 units, which is a great desideratum in connection with boiler drafts as the weight of air required for combustion is proportional to the composition of the fuel.

To burn one pound of carbon to CO_2 (carbon dioxide) the product of perfect combustion, 11.5 pounds of pure air would be required, consisting of 2.6 pounds of oxygen and 8.9 pounds of nitrogen, and the products of combustion would represent 3.6 pounds CO_2 and 8.9 pounds of nitrogen. If such conditions could be secured in daily practice our coal bills would be cut in half and our chimneys freed from smoke. When every particle of carbon combines with its share of oxygen a temperature of a little over 5,000 degrees F. is reached: This is not possible under working conditions as the smallest amount of air possible to work with is 15 to 16 pounds per pound of coal and this only with mechanical draft, so that the highest possible temperature would be 3,600. degrees.

With natural draft thin fires must of necessity be the rule thus permitting from 24 to 30 pounds of air per pound of coal to pass through the furnace, and only a temperature of very little more than 2,000 degrees to be obtained. These figures are worthy of careful consideration as the available heat if absorbed raises the temperature of excess air and does not raise steam as was intended.

Take the general practice in a boiler house. The day's run is commencing and the fireman is beginning to stoke, throwing the first few shovelfuls of coal to the back of the fire and finishing with a shoveful or two over the dead-plate, the doors being then carefully closed and all air carefully excluded. The number of shovelfuls used will be about eight per boiler. Observe the chimney—a copious emission of dense black smoke, lasting three or four minutes, and if a pyrometer were placed in the side flue there would be registered a fall in temperature of 60 to 80 degrees. Black smoke may contain as much as two grains of solid matter per cubic foot of smoke and as fully 300 to 400 cubic feet of air are supplied either directly or indirectly per pound of coal, it is a safe estimate that during the black smoke period 10 per cent. of the fuel thrown on the fire escapes by means of the chimney.

After the smoke has ceased the fire might at first glance appear to be in good condition but when a sample of flue gas is taken the CO_2 as a rule, is only present to the ex-

tent of 5 per cent or even less. A closer examination of the fires may show that at various points the bars are not covered allowing an inrush of air which cools down the flues. Assume that 12 or 15 minutes have elapsed since the last firing, while the steam gage begins to fall, more fuel is thrown on resulting in a further cooling of the furnace; the steam now rapidly falls and in an attempt to avert this result the poker is used with the effect of assisting in sending fine particles of carbon up the chimney and fine red hot coals through the grate-bars into the ashpit below, providing a loss at both ends of the chimney.

To continue the illustration a point further, steam jets which are placed under the grate-bar may be brought into play, a good feature of which is to keep the grate bars cool; but they also force the air through the air spaces at such velocities that, although they may have reduced the smoke somewhat, they send smut and grit out of the chimney instead. The steam also increases the evaporative duty of the boiler but requires practically the whole of the increase to maintain itself, thus robbing Peter to pay Paul. It is no uncommon thing to come across jets taking 8 or 9 per cent of the steam made and in some cases they have been known to take as much as 15 per cent. of the steam generated.

During a test made with five boilers for the consumption of coal and water evaporated, the first test was made with powerful steam jets fixed under the bars, and the results were 27.3 pounds coal consumed per square foot of grate and the evaporation from and at 212 degrees was 9.8 pounds of water per pound of coal consumed and the temperature of economizer water 166 degrees. With induced draft the coal consumption was 25.4 pounds per square foot of grate and the evaporation 10.2 pounds of water per pound of coal and the temperature of the economizer water 259 degrees. On checking these figures against electric current generated during each test, it was found that with steam jets each unit of electricity cost 3.6 pounds of coal and 30 pounds of water, while with the induced draft each unit cost 3.1 pounds of coal and 28 pounds of water, so that with the jets of steam there passed through the fires 2 pounds of water per unit of current, and as 9,000 units were generated during the test, then 1,800 gallons of water which appears as evaporated, never passed through the engines, but was blown directly through the furnaces. After deducting the cost of driving the fan there was a net saving of 14½ per cent. in its favor.

Chimney or natural draft is, under certain conditions, both unreliable and expensive. A chimney 100 feet high, on a bright day, will burn up 20 pounds of coal per square foot of grate surface, whereas on a dull day the draft will not be enough to burn 15 pounds.

To burn a ton of coal by natural draft 24 tons of air would be required and a good coal would produce a temperature of 2,000 degrees but as a temperature of 400 to 450 is required at the base of the chimney there is sent out into the atmosphere nearly 25 tons of gases, carrying off nearly 20 per cent. of useful heat, thus making the cost of natural draft one-fifth of the fuel cost, in other words a coal bill of $50 per week would mean $10 for so-called natural draft. Every one is no doubt well aware of the imperfections of the present system and will be inclined to accept the well known expression—"Our chimneys will appear to the coming generation as monuments of our ignorance."

The use of induced draft is made possible by placing in the flue between the boilers and the chimneys a fan, which may be run by an electric motor. The suction and discharge of the fan are coupled to the flue; a close-fitting damper fixed between these points, so that when the fan is running all the gases from the furnace must pass through it, the damper preventing a short-circuit. As the fan can only get its air supply through the furnace the rate of combustion per square foot of grate will be governed by the speed of the fan.

The grate-bars should be fixed, giving air spaces of ⅜ inch between the front set and ¼ inch between the back set. The furnace doors should also be perforated and an additional bridge wall built behind the original one, as it is necessary to have a supply of air enter at the front of the fires after stoking and also at the back. The air space between the two bridge walls has an opening into the ashpit, permitting a supply of air to pass between the bridge walls and meeting the gases as they leave the furnace, thus making certain of the combustion of any carbon which has not met with its supply of oxygen in the furnace. As a proof of the advantage of the split bridge wall, the temperature in the flues of the boiler was found to be 36 degrees higher than when the air opening into the ashpit was closed, which means increased evaporation.

Micheal Reynolds aptly puts it in his book *The Steam Engine*. "The best way to economize fuel and prevent smoke is to have a thinking head behind the boilers and the coal," or as some one has said, "Have a head behind the shovel." Great difficulty is experienced in convincing firemen that they make smoke by first firing the coal to the back of the furnace, *whereas* if firing were commenced at the dead-plate and ended at the bridge wall there would be no smoke; also the best time to stoke is when the fire is at its best, and less coal is consumed and more water evaporated with a 12-inch fire than with one-half that thickness.

Induced draft makes it possible to maintain a constant temperature under all atmospheric conditions, to burn from 20 to 40 pounds of fuel per square foot of grate as may be desired, it prevents black smoke and soot and avoids any condensation on the economizer tubes, making the scrapers unnecessary. Induced draft if considered in laying out new works would reduce very considerably the initial outlay, as the expense of a chimney would not be incurred, it being merely sufficient to provide a light brick shaft to carry the gases to a sufficient height above the immediate neighborhood, and two boilers could be made to do the work of three.

The National Association of Cotton Manufacturers awarded a medal to the Textile Department of the North Carolina A. & M. College. The requirements necessary to receive the medal are that the textile school shall have a good equipment, that the course shall be of recognized standard, there must be fifty students taking the textile course and there must also be four graduating students to compete for the medal. All of the requirements were fulfilled and the medal was awarded to G. G. Simpson, of Norfolk, Va.

Inquiries about anything pertaining to the textile industries will be cheerfully answered by COTTON.

COTTON MANUFACTURING

PROCESSES IN COTTON MANUFACTURING.

(Contributed exclusively to COTTON.)

BY CHARLES E. BARNHARDT.

PART VII.

There are two kinds of spinning rings in general use, which are known as the single and the double. The single ring has one flange, while the double has a flange on each side, so that when one side is worn out the ring can be reversed and the other side brought into use. In ordinary use, a ring should last from six to ten years. It is false economy to run a ring when it is worn out, as it will soon wear out enough travelers to have paid for a new ring. The rings should be kept clean, so that the traveler will be enabled to move freely during spinning.

SETTING THE SPINDLES AND THREAD GUIDES.

The proper adjustment of the rings and spindles are very improtant matters, and will to a great extent cause good or bad running work according to the way they are set. The spindles should always be set while they are running at full speed. The proper way to set a spindle to a ring is to fasten a wooden block about two inches thick on a bobbin, then place the bobbin in a lathe and turn the block down until it is about one-sixteenth of an inch smaller than the diameter of the ring, care being taken that it is turned on the lathe in such a manner that it will run perfectly true on the spindle.

Before setting the spindles, the traverse motion should be disconnected so that the ring rail will be stationary. The ring rail is raised to near the top of its traverse, the bobbin previously prepared is placed on the spindle, and the spindle then adjusted so that the space between the circular block on the bobbin and the inside of the ring is the same at all points. After setting all of the spindles with the rail near the top, the rail should be lowered and the setting tested in the same manner at the bottom of the traverse, as one or more spindles may not be exactly vertical. Sometimes the spindle rail or the flat surface of the spindle base, which rests on the rail, is not true, and in this case it is necessary to put a few thicknesses of paper or card board between the base and the rail in order to make the spindle stand vertically and have it to run exactly in the center of the ring whether the rail is up or down.

It is also important that the thread board guides be set so that the back portion of the inside of the guide is directly over the top of the spindle. A good way to adjust the thread guides is by means of a small plumb bob, the cord attached to the plumb bob being held against the inside back of the guide, (the point that the thread touches it in spinning) and the guide adjusted so as to allow the center of the plumb bob to be directly over the top of the spindle.

SPINNING RINGS.

The determination of the size of ring which will give the best results in spinning a certain number of yarn is a matter which requires some experience and judgment. It will be readily understood that the larger the rings, the more yarn there can be wound on the bobbins, and thus the frame will not have to be stopped for doffing so often, which is an improtant item in their favor when a large production is taken into consideration. But if the rings are too large for the yarn spun, the strain of the travelers on the threads will be too hard when the bobbins are first started and cause the ends to break, as it will be understood that the pull of the traveler on the thread is less when the bobbin is full than when empty, due to the increased surface speed of the full bobbin over the empty one. Larger rings are better adapted for making coarse and hard twisted yarn than for fine and soft twist yarn. Bobbins of filling yarn are usually made smaller than warp yarn, for the reason that most loom shuttles will not hold a very large bobbin, consequently the rings for filling frames are usually made smaller than for warp frames. The size of spinning rings varies from 1⅜ inches to 2¼ inches in diameter.

Spinning frames are built with from 160 to 288 spindles, the usual number being 208, which is the total number of spindles on both sides of the frame. The power required for driving from 75 to 125 spindles is one horsepower, depending on the number of yarn being spun and the condition of the frame. Spinning frames are usually placed end to end in a mill in rows with the pulley ends of the two adjoining frames facing each other and with an alley of from three to four feet wide between each row of frames. By this arrangement four frames can be driven from one overhead counter shaft, this being the usual arrangement for driving them. This arrangement also brings one side of a frame to face one side of another frame, and thus make an alley for the spinners to work in. Spinning frames are also built in different gauges, that is, the distance from center to center of the adjoining spindles; the gauge most generally used being 2¾ inches.

CALCULATIONS.

The calculations found necessary in spinning frames are those relating to draft, twist and production. The best method for calculating the draft is to find the draft constant, using the same rule as has been given for finding the draft constant on the roving frame, which is as follows: Consider that the delivery roll is the driver, multiply together all the driven gears and the diameter of the delivery roll, and divide this product by the product of all the driving gears and the diameter of the feed roll, leaving the draft change gear out of the calculation. This result will be the draft constant; then in order to find the required number of teeth in the change gear to produce a certain draft, we divide the draft constant by the draft required and the result thus obtained will be the number of teeth the draft change gear should have. If the result is a certain number of teeth and a fractional part of a tooth, we have to select a gear with the nearest number of whole teeth, which in turn will not give the exact draft required. When it is desired to spin a different number of yarn without changing the hank roving, the rule for finding the proper draft gear is as follows: Multiply the number of yarn being spun by the number of teeth in the change gear being used; divide this product by the number of yarn desired to be made, and the result will be the number of teeth that the change gear should have.

To find the twist constant on a spinning frame, it is first necessary to find the ratio of the speed of the cylinder to that of the spindle, that is, the number of revolutions that the spindle makes to one of the cylinder. This may be ascertained in a practical way by turning the cylinder

around one time and counting the number of times that the spindle turns. The ratio may also be calculated by dividing the diameter of the cylinder by the diameter of the whorl. When the ratio is found, multiply this by all the driving gears to the front roll which we will consider a driver, then multiply together all of the driven gears and the circumference of the front roll, and divide this into the first product obtained and the result will be the twist constant. The twist gear is left out of the calculation. When the twist constant is known, in order to find the gear to produce a certain twist, divide the number of turns per inch required into the twist constant, and the result will be the number of teeth required in the twist change gear. An easy method of finding the twist gear when a known twist gear will produce a known twist, is as follows: square the number of teeth in the gear being run and multiply this product by the number of yarn being made; divide the product thus obtained by the number of yarn to be made, and the square root of this result will be the number of teeth the twist gear should have.

To calculate the production, multiply the number of revolutions of the front roll per minute by its circumference in inches and by the number of minutes run in one day. This result divided by 30,240 (36×840) will give the hanks per spindle per day, and this result multiplied by the number of spindles on the frame and divided by the number of yarn spun will give the production in pounds per day of the entire frame.

The standard twist per inch for warp yarn is 4.75 times the square root of the number of yarn required, while the standard twist per inch for filling yarn is 3.25 times the square root of the number. The draft on spinning frames varies from 6 to 10 for single roving, and from 7 to 12 for double roving, depending on the number of yarn to be spun. Coarse yarn requires less draft, while finer yarn requires more. In spinning 26s to 30s yarn from double roving, the draft should be about 10.

BANDING.

The banding of a spinning frame is a very important item. It is usually done by boys who do not realize the importance of having a uniform tension on all of the bands. If a band is tied on too loosely, it will cause the yarn to be soft because it does not receive the full amount of twist and it will not be wound on the bobbin tight enough. When a band is tied on too tightly, too much power is required to drive the spindle. The bands should all be of uniform size, as a smaller band will naturally run deeper in the groove of the whorl of the spindle and make it turn faster than a larger band would, thus causing a difference in the twist in the yarn on that particular bobbin. This may appear to many persons as a very insignificant matter, but experience has proven it to be one worthy of due consideration and attention.

STEEL ROLLS.

The steel rolls should be taken out and thoroughly scoured with whiting, about once in every six months, which is best performed with a piece of card clothing. After thus scouring the rolls, the flutes should be thoroughly cleaned out with a stiff brush.

On account of the youthfulness of the help employed in the spinning room, this department probably requires closer attention and more careful supervision than any other in the mill. A large production is always desirable, and in order to secure it, it is necessary that the frames be kept in good order and run at as high speed as is practical. No fixed speed for the front roll for different numbers of yarn can be given, as this will vary under certain conditions. However, if the ends are continuously breaking down with no apparent cause for it, reducing the speed of the front roll by means of changing the driving pulley of the frame will usually remedy the trouble. When this is done, the production of the frame is of course reduced.

The leather top rolls should be closely watched, and any that become rough or fluted should be replaced by a newly covered roll. The leather top rolls, resting on the front steel roll, should be in better condition than those for the back roll, and it is a custom in some mills to use the front top rolls, after they have been run awhile as such, for the back rolls, using all the newly covered ones for the front roll. In putting in the leather rolls, care should be taken that they be placed so that the lap of the leather cover points in the opposite direction to the motion of the bottom roll, in order to prevent the lap, where the cover is joined together, from being turned up by the friction of the steel roll.

The lint which accumulates on the bearings of the top rolls should be picked off every day, and the roll bearings kept well oiled, so that they will turn easily without sticking. When a traveler becomes worn, it will sometimes cause the end to break, and as it is rather difficult to detect a worn traveler it is the custom in many mills to put new travelers on all the rings at stated intervals, say about every three weeks. Travelers are rather expensive but this plan is perhaps as economical as can be had and get good results.

The atmospheric condition of the spinning room is responsible, to a very great extent, for the good or bad running qualities of the work. The temperature of the room should be, at all times, about 80 degrees. To keep the temperature down to this point in the summer it is necessary to use mechanical means of humidifying. Humidifiers send a fine spray in the room and a sufficient number are operated to keep the temperature down to what is desired.

The oil used for lubricating the spindles should be very light and of the best quality obtainable. It is false economy to use a cheap oil, as it will cause the spindles to stick and gum up, and consequently require more power for driving them.

YARN TROUBLES.

Cockled yarn is caused by long and short stapled cotton being mixed and run together, when the rolls are set for the short stapled cotton. The rolls are set so close together in the stand that the long fibers in passing through are caught by the front rolls before they are released by the middle set of rolls and are consequently broken.

Kinky or snarled yarn may be caused by putting too much twist into it, or by using too light a traveler for the yarn being produced.

Slack twisted yarn and soft bobbins may be caused by the bands being too slack, or by the spindles not being properly oiled, so that they do not respond fully to the pull of the bands.

All spinning frames should be examined carefully and thoroughly overhauled once a year. It is sometimes necessary that the frame should be releveled, the rings and guides should be reset, and the bolsters should be reset, so that the spindle will be perfectly vertical, in order that it will be in the center of the ring at all positions of the ring rail. The ring rail should be given a good bath in a hot

solution of sal soda, and afterwards rinsed in hot water; this will remove all rust and grease from the rings and rails. The bearings of the lifting rods of both the ring rail and the separators should be kept clean and well oiled in order to prevent them from sticking, while the frame is in operation.

When a mill is running on several different numbers of yarn, it is sometimes necessary to ascertain the average number being spun. The rule for finding this is as follows: Multiply each number of yarn by the number of pounds of that count produced, and divide the total thus obtained by the total number of pounds of the different counts; the result thus obtained will be the average number.

THE MAKING OF A THREAD.

TURNS PER INCH FOR DIFFERENT THREADS. TWO-FOLD TWIST TABLE. SIX CORD TWIST TABLE. CONSTANT NUMBERS FOR HEAVY PLY CORDS. NETTINGS. KNITTING AND MENDING YARNS. FANCY THREADS.

(Contributed Exclusively for COTTON.)

BY SAMUEL WARD.

1st Honor Silver Medalist and Clothworkers' Company Prize. Lecturer in Cotton Spinning.

PART VI.

It is advisable to keep in stock travelers ranging from 12s to 24s so as to be available for use at any moment.

For dry doubling, spinning rings and spinning travelers are generally used, though wet doubling travelers are equally suitable, but very little dry doubling, comparatively, is done on ring frames.

Turns per inch: Taking the standard turns as 1.0 other most common degrees of twist—chiefly gassed 2-fold are in the following relative proportions:

Medium	0.85
Soft	0.7
Extra soft (X soft)	0.55
Extra extra soft (XX soft)	0.45
XXX soft	0.38
XXXX soft	0.33
Lisles	1.125
Hard	1.25
Extra hard	1.35

A leakage of 5 per cent. of twist between calculated and actual, and a variation between one thread and another not exceeding 10 per cent. may be passed as satisfactory.

Below is given a table of calculated turns for the 9 degrees of two-fold enumerated above from 12s to 120s with the proportion each bears to the usual.

TWIST TABLE FOR TWO-FOLD THREADS.

Counts	Med. 0.85	Soft 0.7	X Soft 0.55	XX Soft 0.45	XXX Soft 0.38	XXXX Soft 0.33	Lisle 1 1/2	Hard 1.25	X Hard 1.35
12s	12 6	10.3	8.8	6.6	5.6				
16s	14 4	11.8	10 1	7.6	6.4				
20s	15 8	13.0	11.1	8.3	7.0				
24s	17 2	14.1	12.0	9.1	7.7				
30s	19.0	15.6	13.8	10.0	8 5	6.7	25.0		
36s	20.5	16.8	14.4	10.8	9.1	7.3	27.0	30.1	33.5
40s	21.5	17.7	15.2	11.4	9.6	7.8	28.5	31.5	34.1
50s	23.4	19.2	16.4	12.4	10.4	8.7	31.0	34.4	37.1
60s	25.0	20.4	17.4	13.2	11.2	9.5	33.0	36 7	39.7
70s	26.5	21.8	18.6	14.0	11.8	10.3	35.0	39.0	42.1
80s	28.0	23.0	19.7	14.8	12.5	11.0	37.0	41.0	44.0
90s	29.3	24.1	20.6	15.5	13.1	11.6	38.5		
100s	30.6	25.2	21.6	16.2	13.6	12.3	40.0		
110s	31.8	27.0	23.0	17.1	14.4	13.1			
120s	33.0	28.1	24.0	18.0	15.2	14.0			

It will be observed in the hard and extra hard sorts, there are in 40s about as many turns as in 80s "usual," and in 80s as many as in 120s "usual." In attaining these high twists there is a great sacrifice of strength, the fibers more or less being broken, but it is necessary to have the twist in order to produce a certain effect in appearance in the manufactured goods, as in crape, etc., the yarn for which must be made on the flyer doubling frame adapted to the requirements of the buyers of the yarn.

Sewings. 3-cord sewings require about the same twist as 3-fold "usual" so it is unnecessary to repeat the table.

For 6-cord, the following twists are calculated on the assumption that two ends are to be twisted together at the preparing doubler and afterwards 3 of these doubled ends twisted together.

TWIST TABLE FOR SIX CORD.

Counts	2-Fold Preparing.	6-Cord Finishing.
32	18.4	15.8
36	19.5	16.8
40	20.6	17.7
45	21.8	18.8
50	23.0	19.8
55	24.0	20.7
60	25.1	21.7
65	26.1	22.6
70	27.1	23.4
80	29.0	25.0
90	30.7	26.5
100	32.3	28.0
110	33.9	29.4
120	35.4	30.7
130	36.8	31.9
140	38.2	33.1
150	39.4	34.3
160	40.6	35.4

Constant number $= \sqrt{\text{count}} \times 3.25$ for coarse preparing,
$= \sqrt{\text{count}} \times 3.21$ " fine "
$= \sqrt{\text{count}} \times 2.8$ " finishing

As the two-fold preparing is twisted in the same direction as spinning, viz.: twist way, the twist in spinning should not, under any circumstances, be more than weft or the two threads will not readily combine into one and will endanger the strength by breaking the fiber.

Good 6-cord sewings can not be made from hard twisted spun yarns.

In 9-cord (3x3) sewings, the multipliers for 3-fold preparing range from 2.7 to 2.6, and for 9-cord finishing, the multipliers are 2.3 to 2.2. In 12-cord (4x3) the multipliers for the 4-fold preparing range from 2.3 to 2.2, and for 12-cord finishing from 1.8 to 1.7.

4-cord sewings. The most appreciated twists for 2-fold preparing are about the same as "usual" twist $\sqrt{\text{count}} \times 4$ for preparing, and for the 4-cord finishing 10 per cent. less than usual, or $\sqrt{\text{count}} \times 4.2$ to 3.8 for preparing and 3.8 to 3.4 for finishing.

6-cord crochet. The preparing for 2-fold crochet is twisted weft way, and is thus subject, by its harder twist, to breakage of the fiber like "twist upon twist" and preparing for sewings, so harder single can be used, say full weft for the coarser, weft or bastards for the medium, and bastards or even twist for the finer counts.

The finishing of crochet is twisted twist way. The multipliers for twist are:

$\sqrt{\text{count}} \times 6$ for preparing coarse counts.
$\sqrt{\text{count}} \times 5.5$ " " fine "
$\sqrt{\text{count}} \times 2.4$ " finishing coarse "
$\sqrt{\text{count}} \times 2.2$ " " fine "

Four cord crochet. The turns per inch in 2-fold preparing for 4-cord crochet are the same as for 6-cord. The average multipliers for finishing twists are 2.9 to 2.8 in the coarser to 2.7 in the finer.

Nettings. These yarns are mostly made from American cotton, spun twist way with weft turns, used mostly for the making of fishing nets, but also for other goods such as net bags and net screens. These yarns when finished are to be very strong and supple. They range from 6-cord to 27-cord, the number of folds, of course, accounting for the great strength as compared with thickness. A thread made of 3/3s would be same diameter as 21/21s, but as each of the 7-folds of 7/21s preparing is a sound strong thread of itself, it is obvious that a net composed of 21 individual threads will possess an immensely increased tenacity over a 3-cord netting made from the very best cotton. Nettings are wet doubled in both the preparing and finishing processes, the twist in preparing being twist way and in finishing weft way. The preparing twist is the same as sewings both in degree and direction. The finishing twist must be much less in amount than sewings so that it will not curl in the hank, otherwise it will be difficult to work afterwards when being made into fishing and other types of nets, and however the nettings are made they must on no account be deprived of their suppleness. In the first twisting or preparing, the yarn having full sewing twist, its curliness disappears after the balancing effect of the second or finishing twist.

The following table gives a list of multipliers for netting twists:

MULTIPLIER FOR NETTING TWISTS.

Cord.	Number of folds in preparing.	Multiplier for preparing.	Multiplier for finishing.
6	2-fold	3.2	2.7
9	3 "	2.7	2.2
12	4 "	2.34	1.9
15	5 "	2.1	1.71
18	6 "	1.9	1.55
21	7 "	1.76	1.43
24	8 "	1.65	1.34
27	9 "	1.55	1.27

Example:-
16s 6-cord 2-fold preparing.
Turns per inch = $\sqrt{\text{count}}$ = 4 x 3.2 = 12.8 turns preparing.
" " " = $\sqrt{\text{count}}$ = 4 x 2.7 = 10.8 " finishing.

Knitting and mending yarns. As a soft and "kindly" feeling is required in all knitting goods, it is necessary that the yarns from which the knittings are to be made be spun soft with no more twist than what is known to the trade as "soft" or "hose"; and may be spun from Egyptian or American cotton on mules or ring frames. Counts below 10s should be produced on roving or jack frames, but must contain twist proportionate to that required in spun yarns from 10s downwards. For instance, a 5-hank roving for spinning would contain about 2 turns of twist only, but for knitting 4 or 4½ turns would be required for 5s. The doubling frame would have an upright skewer creel adapted for running 3 or 4 ends into one.

For 10s and upwards, the ordinary "porcupine" creel may be used 3-fold for 3-fold and 2 two-fold bobbins for 4-fold. The correct twist for knitting is $\sqrt{\text{of the net counts}} \times 3.3$, the net counts of 3-fold 6s being equal to 4-fold 8s, and would require the same turns, say 4½ turns per inch. It is preferred to use separate multipliers. The $\sqrt{\text{count}} \times 1.87$ may be used for 3-fold and 1.6 for 4-fold. Sometimes 5 or 6-fold knitting may be required in the finer counts, in which case the net multiplier given above can be relied upon. All knittings are doubled dry and are, of course, always ungassed.

Embroidery. These yarns are required to be finished with a silky or lustrous surface. Combed yarns must always be used whether gassed or plain. The coarsest counts of embroidery are made from rovings, and the higher counts, from 10s to 12s and upwards, from spun yarn. The former are "double spun" (a process which will be referred to subsequently) single on a flyer twister in order to make the roving or slubbing into yarn fit for working on the finishing twister. The amount of twist depends upon what is already possessed by the single roving and on the counts, which, by the way, are sometimes as low as 1s. Many of these beautiful threads are made from 2-fold and 3-fold 1s to 2-fold and 3-fold 12s and so on. When embroideries are of 10s and upwards, the spun yarns twist have weft turns, so as to give the final result of parallel position of the fiber when doubled.

The proper twist for 2-fold embroidery made at one process from combed weft is $\sqrt{\text{count}} \times 3$ and for 3-fold $\sqrt{\text{count}} \times 2.3$. These are, of course, the finishing twists and will be found a safe guide to produce not only the effect mentioned, but also a supple and smooth thread that will uot curl when reeled off the bobbin or spool.

There is an almost unlimited variety of fancy sorts and folds such as the following:

6 ply 2/40s gassed made as follows:

1st process: 2/38s super comber weft twisted weft way with 10 turns, wet.

2nd process: gassed.

3rd process: twisted 6-ply twist way, dry. With 1½ turns, wet.

8 ply 2/80s gassed XX soft:

1st process: 2/14s super combed twisted weft way 14½ turns wet.

2nd process: gassed.

3rd process: twisted 8-ply twist way, dry, 1¾ turns.

It is sometimes necessary to produce a corded thread having the appearance of a spiral. This effect is obtained in one of two ways:

(1) Two double threads of the same counts are separately twisted on the preparing doubler, the twist in one being inserted in the opposite direction to that of the other. When the two threads thus produced are twisted together at the finishing doubling frame a spiral thread is produced.

(2) If two threads of different counts and separately twisted on the preparing doubler (twist being inserted in the same direction in this case) be finally twisted together a thread spiral in form is produced.

2-fold spiral 1s and 12s counts:

1st. Slubbing containing 1 turn is further twisted on flyer doubling frame, wet, adding 3 turns twist way. Then 12s soft weft or hose wound single. These two strands are then twisted together (wet) weft way with 5 turns and afterwards gassed.

2-fold gassed spiral 2s and 12s made from 2s roving or intermediate containing 1½ turns further twisted, twist way wet, with 4¼ turns. 12s soft wet or hose. The two strands are then blended, weft way wet, with 7¼ turns and afterwards gassed.

2-fold spiral gassed 4s and 20s: 4s roving with 2 turns

further twisted, twist way wet, with 6 turns. 20s soft hose or weft. These are blended, weft way, with 7 turns and afterwards gassed.

Cordonet. Smooth and lustrous cords known as "cordonet" are usually 2-fold, and are made from roving or slubbing, carded or combed, according to quality, from 1s to 8s or 10s, in the same manner as the corresponding counts of embroidery. In the double spinning of the sliver for this purpose, it is generally requisite to move the guide rail to the right hand end so that the rove shall enter the rollers close to the right hand pivots of the top roller, or the hard twisting will cause it to creep off at the left hand end of the roller. The degree of twist being so great in this first process of double spinning that, to avoid the evil mentioned, it is sometimes necessary to guide the rove over the top roller and deliver it from under the bottom roller to the spindle.

The finishing process requires the same proportion of extra twist, compared with embroidery, as the double spinning does in order to secure the desired effect of parallel fibers.

Should these extreme twists be found too great, they may be relaxed in both processes 10 per cent. or thereabout.

For double spinning for these counts, a specially constructed upright skewer creel is necessary, so arranged that the rove will not come off the tube at an acute angle, but in as direct a line as possible, or the little twist the rove contains will come out before reaching the water.

DRUM AND STUD GEARS FOR TWISTERS.

(Contributed Exclusively for COTTON.)

BY STEPHEN E. SMITH.

Twisters are sometimes required to give a great range of twists per inch in the yarns according to the product made. For this reason it is customary for the machine builder to provide more than one place for changing gears and it is the practice to change the drum and stud gears whenever a radical change in twist is desired.

It sometimes happens in the manufacture of ply yarns, that a number of twists per inch is called for, which makes it necessary to obtain a new combination of drum and stud gears for the twister.

Let it be assumed that six twists per inch are required and that it is necessary to use a new set of drum and stud gears. When securing a new combination, it is advisable to get one which will give an equal range above and below the required standard—say from four to eight turns per inch. The actual range which can be obtained with any one combination of drum and stud gears depends upon the range on hand in the number of teeth in the twist change gears T., shown in the accompanying illustration.

If, for example, the twist change gears range from 20 to 40 teeth as they do on one make of frame, then it will be possible to obtain extreme twists in the ratio of 2 to 1, that is, if the 40 toothed gear gives 18 twists per inch then the 20 toothed gear will give just twice as many twists per inch (36), because the smaller gear will drive the front roll just half as fast as the large one.

If the twist gears ranged from 20 to 60 teeth then extreme twists per inch in the ratio of 3 to 1 could be obtained.

CHANGING DRUM AND STUD GEARS.

In making these changes it is necessary to know three items, viz.: (1) the range of twist change gears on hand; (2) the sum of the teeth in the present drum and stud gears, and (3) the twist per inch required.

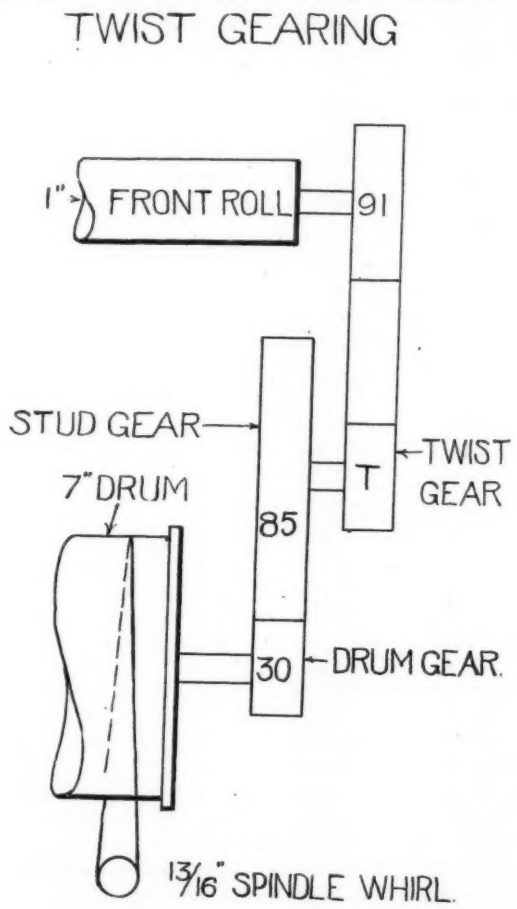
Let us assume the following example:

The twist gears on hand range from 20 to 40 teeth, the sum of the teeth in the drum and stud gear is 115 (30+85), and it is desired to find a combination that will give a range of 4 to 8 twists per inch.

As the least number of twists per inch is 4, this number must be obtained when using the largest twist gear, that is, one having 40 teeth.

The problem is really one in algebra in which there are two unknown quantities to be found, namely the numbers of teeth in the new drum and stud gears.

When calculating by algebra, it is necessary to form equations, in which the unknown quantities are represented by letters. In our example, let X stand for the number of



GEARING FOR A TWISTER.

teeth in the drum gear and Y for the number of teeth in the stud gear. We then have the following equations:

(1) X+Y=115.

This is true, because the sum of the previous combination was 115 teeth and it is necessary to have the sum of the new combination equal 115 teeth, in order for the two gears to mesh properly when put into position.

Referring to the illustration for the gearing, we have the following equations, in which the new drum and stud gears are represented by X and Y respectively.

(2) $\frac{91\times Y\times 7.58}{40\times X\times 1\times 3.1416}=4$ twists per inch

In this statement it is assumed that the front roll is one inch in diameter and that the largest twist gear of 40 teeth is used. The final result would be just the same if the smallest gear (20) and the greatest number of twists per inch (8) were used in the equation, instead of these figures. 7.58 is the ratio of the whorl to the drum. The gears X and Y must be such as will enable the 40 toothed twist gear to give 4 twists per inch. We now have the two equations (1) and (2) which are necessary in order to find the numbers of teeth in the two new gears to be used.

We will now reduce equation (2) to its simplest form, by multiplying together the figures and letter on top of the line, and the same way with the figures under the line, and the result is as follows:

(3) $\frac{689.78Y}{125.6\ X}=4$

This equation may be expressed thus:

$689.78Y=4\times 125.6X$

$689.78Y=502.4X$

By transposing and changing the figure to a minus quantity, we have:

(5) $689.78Y-502.4X=0$

Now multiply the first equation (1) by 502.4 and add it to equation (5)

(5) $689.78Y-502.4X=0$

(1) $502.40Y+502.4X=57776$

$1192.18Y\ \ 0\ =57776$

502.4 was taken as a multiplier in this case in order to make the plus and minus values of X cancel each other.

Adding the plus and minus quantities of X gives zero. Then if $1192.18Y=57776$; Y will be equal to: $57776\div 1192.18=48.4=48$ stud gear.

If Y has 48 teeth, then X must have 115—48 or 67 teeth, drum gear.

To prove the correctness of the result it is only necessary to work out the train of twist gearing (2) using the gears just found in place of the letters, thus:

$\frac{91\times 48\times 7.58}{40\times 67\times 1\times 3.1416}=3.93$ twists per inch.

The result would be exactly 4 if it were possible to use a 48.4 gear as found in the example, but of course fractional parts of a tooth can not be used. By using the same method, new twist combinations for any range of twists desired on any frame may be found.

YARN SIZING.

(*Contributed Expressly for* COTTON.)

BY F. W. HORROCKS.

Cotton manufacturing owes a great deal of its success to what may correctly be called the "science and art of sizing." We produce all kinds and qualities to suit all markets, and to accomplish this we use all kinds and qualities of raw cotton. All cotton yarns, except ply threads, require sizing before being put in the loom, and the method of sizing, the kind and proportion of size required, depends upon the class of cloth to be woven.

The proportion of size to weight of yarn varies from 5 per cent. to 200 per cent. A size mixing up to 20 per cent. is called a "pure" size, from 20 to 50 per cent. "medium," and 50 per cent. upwards "heavy" sizing.

The original purpose of sizing was to strengthen the yarn by coating it with an adhesive substance, so as to lay all the fibers to the yarn and keep them there. The shorter the fibers are, the more size in proportion to the weight of the yarn is required; and as a considerable amount of short staple cotton is worked up in our mills, we require a medium or heavy size to get the yarn through the loom. For the domestic trade; for goods which have to be afterwards bleached or dyed; and for most classes of fancy or figured goods a pure size is used. Sizing not only strengthens the yarn, enabling it to withstand the strain and friction of weaving, but it improves the appearance of the cloth by making it fuller.

A pure size consists principally of rice flour or potato starch and water, though some sizes add a little wax to soften, and zinc chloride to prevent mildew. Paraffin wax is considered objectionable in the case of goods which are to be afterwards dyed. Rice flour is very largely used in India for those goods in which potato starch is used in America.

In size mixings, required to put 50 per cent. of size on the yarn a greater variety of ingredients are used. A rule easily remembered is that for a 50 per cent. mixing, half as much china clay as starch is used; for 100 per cent. use as much clay as starch. For heavier sizes increase the proportion of clay to starch to suit the requirement. The addition of china clay, however, necessitates the addition of other materials to aid in fixing the clay, and also to render the yarn pliable. For instance, for a 50 per cent. mixing we could use:

wheat starch	500 lbs.
clay	250 lbs.
tallow	100 lbs.
chloride of zinc	40 lbs.
chloride of magnesium	30 lbs.

Add about 4 ounces of blue to improve the color.

For heavy sizing, say 100 per cent., the following mixing is suitable:

starch	560 lbs.
clay	560 lbs.
tallow	120 lbs.
chloride of zinc	50 lbs.
chloride of magnesium	50 lbs.

The chloride of zinc is much heavier than the chloride of magnesium. A gallon of chloride of zinc weighs 7 pounds, while a gallon of chloride of magnesium weighs only 3¾ pounds. In order to prevent mildew which would be induced by heat and dampness, the chloride of zinc is used as being the best antiseptic that can be used.

MACHINERY.

The greater proportion of yarn is sized on the slasher. The finest yarns—80s and upwards are often prepared and sized on a dressing frame, though the improvements which have been made in the slasher have caused the dressing frame to be thrown out in many mills.

Formerly sizing machines were provided with only one cylinder, but now there are some two-cylinder machines in use. In a slasher, the warper's beams are arranged in a framework at the rear of the machine, and are set with half the number of beams at a higher level than the other half, so as to permit the sizer to insert dividing cords, so that ends may be separated after being sized. All the ends from the warps form a sheet which is brought up from below the warp nearest the sow box into which it is immersed. In the case of heavy sizing the yarn passes underneath an immersion roller which can be raised or depressed

by means of a rack and wheel, so as to regulate the amount of size put upon the yarn.

In light sizing, the yarn simply passes between a pair of rollers, the lower or copper roller, being in the trough, is sufficient to put the size on the yarn. The yarn passes between one or two pairs of rollers, the top ones covered with flannel which press the size into the yarn, and also press the surplus out of it.

A single cylinder machine has a 9 foot diameter cavity cylinder, that is, one in which the steam is only round the cylinder. A double cylinder machine has a 6 foot and a 4 foot cylinder. On leaving the rollers the yarn passes over and round the cylinders, being kept in contact with them as much as possible. The yarn is then brought forward underneath the cylinders, a revolving fan assisting in the drying of the yarn. The yarn is then brought up and passed round a roller known as the pin roller or measuring roller. The ends are then separated by means of rods, and are wound upon a weaver's beam, a pair of weighted pressure rollers keeping the yarn tight upon the beam.

In the most modern machines the measuring roller is at the front and is thus in a more convenient position. A slowing motion is now applied to most machines, for the purpose of allowing them to be run at a very slow speed while the operator attends to broken ends, or changes the weaver's beam. A complete stoppage of the machine would tend to injure the yarn by burning it, or drying it too much, and some machines are so arranged that when they are slowed down or stopped the supply of steam to the cylinders is cut off at the same time.

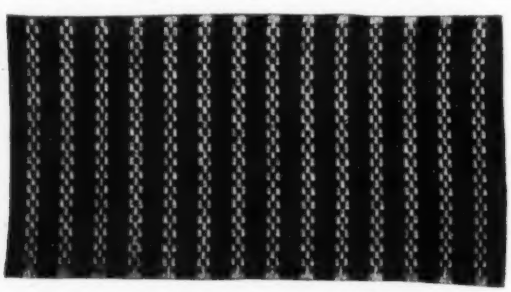
PREPARATION OF COLORED WARPS FOR THE LOOM.

(*Contributed Exclusively for* COTTON.)

BY J. W. K.

The preparation of warps for colored goods varies according to the class of fabric required to be produced. In view of this, we propose to show the method of giving the instructions for the three most important systems, namely, section warping, mill warping, and colored dressing.

SECTIONAL WARPING.—The warps are made by this system by means of winding yarn from the bundle, dyed or bleached on to a warper's bobbin. These are then



COTTON FABRIC.

placed in a V-shaped or a circular creel, as may be desired, according to pattern required. Example: It is required that a warp be made to the following order: 2,400 threads in the warp, including 32 threads for selvages, 18s warp, 800 yards long. It is usual to allow about 5 per cent. waste. The fabric to be produced is shown in the accompanying illustration, the warping pattern for which is as follows:

10 threads dark blue.
6 threads white.

16 threads per pattern.
2400 threads—32=2368 threads.
2368÷16=148 patterns.

In order to have the pattern in the fabric evenly balanced at the selvages, it is necessary to start the warp with six blue threads after the selvage has been put in.

The lay-out for the warps on 10 sections would be as follows:

1st. Section { 16 threads selvage. 6 threads blue. 4 threads white. 13 patterns.

2nd to 9th Sections. 15 patterns each.

10th Section { 14 patterns. 4 threads blue. 16 threads selvage.

=148 patterns + 32 threads selvage = 2400 threads.

MILL WARPING. The preparation of the bobbins for creeling is the same as that for sections, but very often only half the bobbins are required by the mill warper, as his creel is generally only half the size. In this case the creeling would be the same, but instead of beaming on to the sections it would be run on his revolving circular mill 10 times up and down until the desired length and number of patterns were run. After this he pulls the warp off in rope-like form ready for the beamer.

DRESSING. The yarn for this system is ordered from the spinner in grey warps, for dyeing or bleaching, according to the pattern required. For Fig. 1 they would be ordered as follows:

Blue = 10 threads per patt. × 148 patts. = 1480 threads
White = 6 threads per patt. × 148 patts. = 888 threads
White = Selvage = 32 threads

Per warp, 2400 threads

Thus we find that two warps would be ordered from the spinner to the dyer and bleacher as required above. When dressing the warp, the dresser places the selvage threads at the left side in a reed, after which he proceeds to lay the pattern, beginning the pattern so that it will be evenly balanced, then finishes up with the selvage on the right side. After this, the warps are run on to a weaver's beam and a lease is picked by the dresser near the end of the warp.

These systems will apply to any number of colors or lengths of warp. As regards bobbins of each color required, the following rule will always work out:

Color per pattern × patterns required = bobbins of each color required. Rule for warps: Color per pattern × patterns required + selvage = number of threads in each warp required.

PRACTICAL POINTS ON LOOM FIXING.

(*Contributed Expressly for* COTTON.)

BY GEORGE RICE.

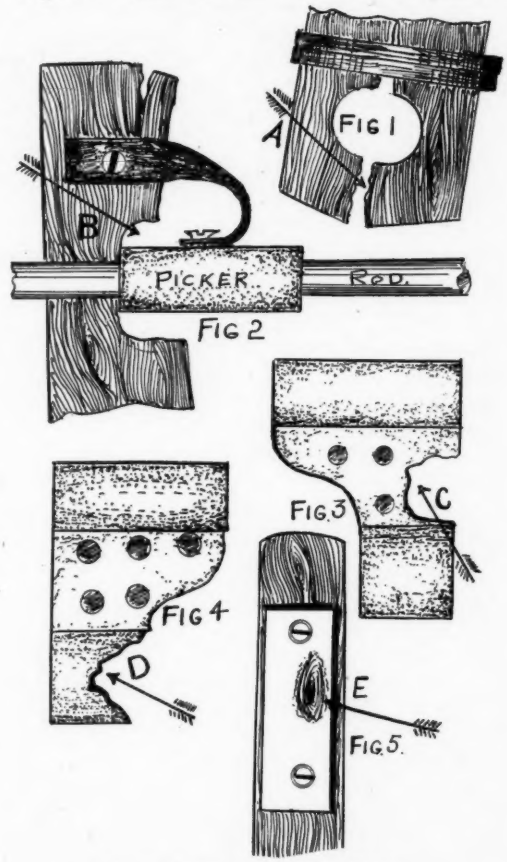
In passing through a weave room in a cotton mill you will very often notice that some of the looms in one certain section of the room are picking harder than the looms in charge of a fixer in another section. Experience

tells you that something is wrong with hard picking looms. It is not possible to get as much work, or as good work from the hard picking loom as from the easy picking loom, as all mill men know. We sometimes find that the section hand is negligent when it comes to the nature of the pick of the loom, and if the loom will run and the weaver is satisfied, the section hand does not give it any more attention.

The unusually hard pick of looms will produce breakage in the yarns. The harsh pick will also cause the loom to vibrate more, and a jarring motion can be detected by standing next to the looms.

We will now inquire into some of the reasons for the hard picking motion in looms, and in order to give a clear idea of each difficulty, the accompanying illustrations are given.

Figure 1 shows that the bottom of the picker stick



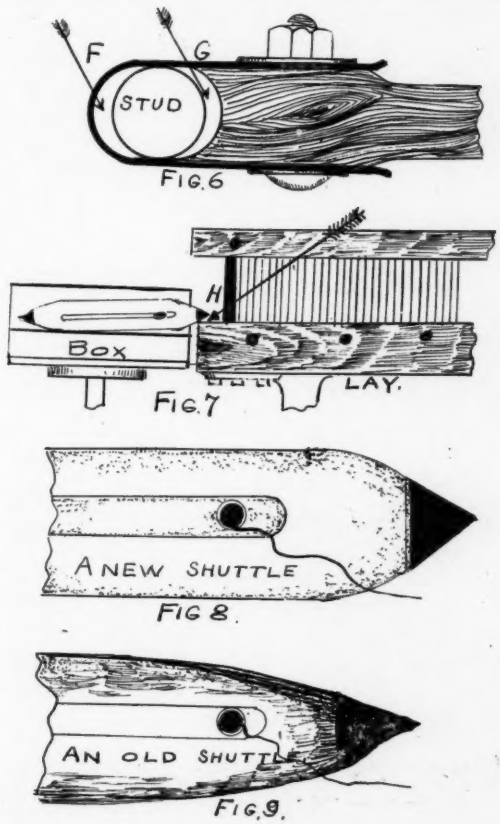
WORM PICKER AND PICKER STICKS.

was split at A. Instead of putting on a new stick, the section hand had patched the break by binding some pieces of leather about the split stick, as shown. The straps held the stick together at the gap, but at each pick of the loom the gap expanded. The pressure of the tappet on the sweep strap pulled open the fracture at each pick, resulting in a loss of motion, and this loss of motion caused the hard picking motion of the loom. A new stick would be the best remedy in this case. Figure 2 shows where the upper part of a picker stick has been worn into by the picker, as at B. The packing in the bunter has dropped out, therefore the stick pounds on the picker at each blow, producing the worn place in the stick. This worn place makes the picker lift a little at each trip of the shuttle from that side, causing the shuttle to tremble across the raceway and the loom to pick hard. A new picker stick will also solve this problem.

Figure 3 shows that the picker itself is worn into, by constant use, as at C. It is impossible to get a smooth, easy pick, with a picker in this condition, and furthermore, with the picker in this shape it is impossible to run boxes with two or more shuttles, hence the picker should come off and a new one substituted.

Figure 4 shows that a harsh pick may be due to the fact that the picker is worn out at D. This worn condition of the plug makes the shuttle run unevenly along the raceway, causing it to "stagger."

It is impossible to get a smooth pick with a shuttle turning in its course out of the boxes in its passage across the lay to the opposite box. The best plan in this case



SHUTTLE TROUBLES.

is to put on a new picker, and free upon the swells of the shuttle boxes, which had been tightened to make the worn picker do its duty when greatly handicapped.

Figure 5 shows a common leather picker, used on plain looms, with the pick or shuttle hole made too far to one side in the picker as at E. The pressure of the shuttle coming on one side of the picker and the stick, causes the stick to turn a little at each pick, resulting in making the pick rough. This may be fixed by re-setting the box, so as to throw the shuttle point squarely into the center, and putting on a new picker.

Figure 6 shows that the stud on the lay is not held tightly, due to the slipping of the strap on the crank arm. The strap has slipped so that there is loss of motion at F and G. This makes a loose, bumping condition of the lay,

and results in a hard pick. This is easily adjusted by pulling the strap up to take up the free motion and then tightening the nut on the strap bolt.

A condition as shown in Figure 7 will not only cause the loom to pick hard, but the shuttle will be thrown up against the upper side of the threads of the loom shed, resulting in chafing and breaking some of them. The trouble is that the level of the shuttle box is so far beneath the level of the race plate, that the forward end of the shuttle is lifted upward out of line as at H, at each trip from that box.

This action also makes the shuttle bind in the box and produce the unnecessary hard pick. By elevating the shuttle box to the level of the race plate the harsh picking and the ripping of the threads of the shed will be stopped.

It sometimes happens that a fixer will replace an old shuttle in a loom with a new one, without making any adjustments. This will cause the shuttle to bind too tightly in the boxes, and the lay will get a good distance back before the picking motion is able to drive the shuttle forward. Of course this makes a hard pick and also increases the liability of the shuttle flying out of the loom. A badly worn shuttle is shown in Figure 9. A shuttle in this condition fits freely in the boxes. The shape of a new shuttle is shown in Figure 8. It is easily seen that the boxes without any adjustment are too small for the new shuttle, and the same will bind more or less, thereby making the hard pick. This may be adjusted by opening out on the box swells, so as to give more space to the increased size of the shuttle.

WOOL MANUFACTURING.

TWIST IN WOOLEN YARNS.

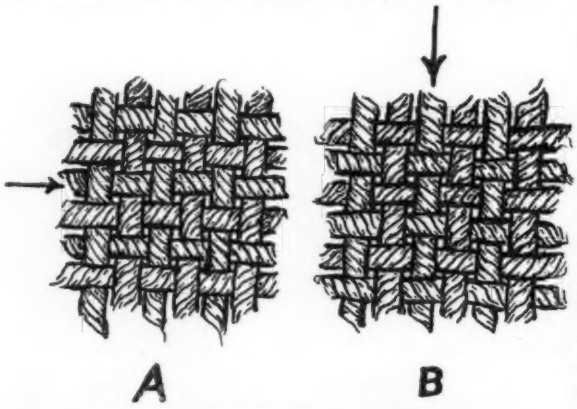
RESULTS FROM THE USE OF VARIED TWISTS. RULES FOR DETERMINING THE WEIGHT OF DOUBLE-AND-TWIST.

(Contributed Expressly for COTTON.)

BY O. F. IRELAND.

In the construction of woolen goods, the matter of twist in the yarn is of great importance, as the amount or character of the twist will often make or mar the character or perfection of the cloth.

In cassimeres and similar goods requiring a fairly close finish, the yarn should be well twisted, so that the twill or other weaving effect may show up to advantage.



DIFFERENT TWISTS IN THE PLAIN WEAVE.

Cloth having a right hand twill construction, should have the warp twisted to the right, and vice versa for a left hand twill, as this will insure a clear, sharp twill. A twist, in the yarn, opposite to the twill will result in a twill that is round or flat and is less desirable.

On this same principle herring-bone effects should have both right and left hand twists to correspond with the twills desired. Many herring-bones are made with only one twist in the warp; but the result is that part of the pattern has the sharp twill where the twist corresponds to the twill, while the other part or opposite twill has the flat twill effect.

Goods requiring considerable felt and a clothy feel, as meltons, beavers, kerseys, etc., should, as a rule, have just twist enough to insure their weaving well, and for the best results the filling should be twisted opposite to the warp.

Some other desired effects are dependent upon a combination of opposite twists, and we call attention to a cloth sometimes made for dress goods, and which at one time was very popular, and the "seven years limit" for its return is nearly up. We refer to the so-called tricot, a name it derives from its appearance and not from its construction; for it is not a tricot at all, but takes its tricot effect from twist combination, and is an interesting study on that account. This so-called tricot is nothing more or less than a sacking, or a plain cotton weave flannel, so far as the weave is concerned; but the arrangement of the two kinds of twist destroys the sacking appearance, and produces a resemblance to the tricot weave as sometimes used for heavier goods. While it presents the tricot "barred" effect running crosswise on the face, it also has a similar appearance running warp-way on the back; though the extra twist and closeness of the warp make it less noticeable.

It is interesting to note how this effect is produced, and we give illustrations *A* and *B* to make the cause more easily understood. The construction consists of alternate threads of right and left hand twists in both warp and filling, and the combination results in the tricot effect. It will be seen by the illustration that the fibers in the filling of *A*, as designated by the arrow, lie at about the same angle as those in the warp under which each thread passes, while the angles of the fibers, looking warp way are reversed at every intersection. The illustration *B* represents the back of the cloth and the order is exactly reversed, the fibers lying alike in the direction of the warp instead of the filling, and the tricot effect runs lengthwise as a result. An exchange of shuttles in weaving resulting in a change in the order of the filling, would change the face effect to the back of the cloth, and vice versa. It is the way the fibers lie that gives the cloth its character. The real cause can not be fully explained, that is, why the difference in the twist produces it, except it be from the same cause that produces the sharp and flat twills in the cassimere weave, in which the manner of the intersection of the threads tends to close or open the twist as it lies over the other thread.

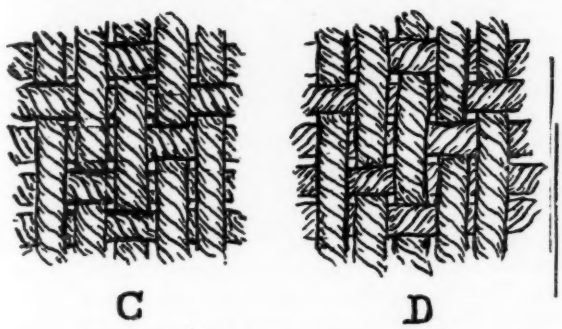
In making these goods for piece dyeing, a slight fugitive stain in one twist will help distinguish it from the other in the weaving. A little blue stain put on the stock with the emulsion in the picker room is the best and cheapest method of marking. In mixtures, a slight variation in the percentage will answer, and help to bring out the tricot effect as well. While the difference in the twist and the way the fibers lie can not be seen with the naked eye, the result is plainly visible in the effect produced; and the

back of the cloth resembles a heavier cloth sometimes called a "tricot long." While the cloth is of the same weave as the sacking, it finishes softer, on account of the influence of the different twists on the fulling.

Another instance of the importance of opposite twists is that of the hair-line and similar warp stripe goods. In the ordinary hair-line of alternate threads of contrasting colors, the matter of twists should not be overlooked nor ignored if the best results are desired. The warp line effect should not be broken by any undue prominence of the filling. In the four harness weave commonly employed for this class of work, the filling comes over the warp thread at every fourth pick, and the less pronounced it appears at this point, the more perfect and continuous will the line appear.

The illustrations C and D show the construction of this weave: the former with opposite twists in the warp and filling, and the latter with one twist all around. In C it will be seen that the filling, being twisted opposite to the warp, has its fibers to lie in the same direction as those of the warp, while in D the case is the opposite.

In looking at these illustrations the natural conclusion is that the construction represented by C is the better, because there is an unbroken succession of fibers lying in the same direction; and the conclusion is amply verified in the appearance of the finished cloth when put to a test.



DIFFERENT TWISTS IN A TWILL WEAVE.

When the warp and filling have the same twist, the hair-line has a "stitchy" appearance that can be avoided only by the use of opposite twists as suggested. What is true of this cloth is also true of other warp face goods, as kerseys, broadcloths, etc., though more plainly visible in the hair-line.

It is impossible to state just why warp and filling of opposite twists insure the best felt in finishing; but actual tests have proven it, and it is a fact well worth keeping in mind where felted and face finished goods are to be made.

Yarn intended for double and twist should have as little twist as possible to handle, and as a rule should be twisted opposite to the twist desired when doubled. Double yarn, twisted the same way as in the single, produces a very hard and wiry effect. In combining fine cotton or silk threads with woolen, opposite twists are not always adhered to. When twisted with the twist of the wool thread, the finer thread is shown more prominently, while the opposite tends to bury the fine thread, and the effect desired often decides the matter. Yarns of about equal size take up equally in twisting; but in unequal sizes the larger thread tends to remain straight, while the finer one wraps around it.

We give the following rules for determining the weight of double and twist yarns, but no allowance is made for the take-up, which gives additional weight.

If the yarns be of the same size, divide the runs by the number of threads; as for example, two threads of four runs equal 2 runs; and three threads of 4 runs 1¼ runs.

Where the threads are of unequal size, if there are but two, multiply their numbers and divide by their sum. For example, 4 runs and 8 runs would equal 2⅔ runs; determined as follows: 4 multiplied by 8 equals 32, which divided by 12 equals 2⅔.

Where there are more than two threads, a short method is as follows: Take the highest number and divide it by itself and each of the other numbers, and then by the sum of the quotients obtained.

If 12, 8 and 4 runs be combined, the process would be as follows: 12 divided by 12 equals 1; 12 divided by 8 equals 1½; 12 divided by 4 equals 3. The sum of these quotients is 5½. 12 divided by 5½ equals 2 2-11 runs double and twist.

IMPARTING SPECIAL PROPERTIES TO TEXTILES.

Valuable properties may be imparted to fibers by other than the physical processes of hot-pressing, steaming and lustering. By chemical treatment, the processes of Knecht and that of Cassella for animalizing cotton, alter it so that it acquires the property of an animal fiber.

By Knecht's process, the cotton is submitted to the action of a solution of lanuginic acid and formaldehyde, then dried and steamed.

Cassella subjects cotton for a long time under pressure to the action of ammonia. Treated by either process, cotton can be dyed with wool coloring matters, but as yet neither has become of practical importance.

However, the chemical processes by means of which wool and cotton acquire properties like those possessed by silk are of especial importance to the dyer. Long ago, in Mercer's time, the fact was noticed and published that when wool is acted upon by chloride of lime, it acquires among other properties, an increased lustre and a hard, rustling handle, greatly resembling the scroop of silk. Towards the end of 1894, a knitting yarn appeared upon the market, possessed of these characteristics, and it was quite obvious to those who had read and studied the subject, that the effect was principally dependent on the action of chlorine. Subsequent experiences have proved this to be the case. It was not very long before the knowledge of the production of this silk-like wool became common property; almost every dye-house, employed in dyeing knitting yarns, took it up.

Many methods have been worked out for imparting the luster and scroop of silk to wool. Of these, chlorine water has been tried, while bromine or iodine have been used to replace the chlorine.

However, the best method has proved to be the use of chloride of lime and hydrochloric acid, by means of which, along with an intermediate soap bath, a scroop very similar to that of silk is produced. Experience has shown that the best method of proceeding is, after thoroughly scouring the wool, to pass it through a weak bath of acid and afterwards work for half an hour in a bath of chloride of lime. The yarn is then allowed to drain, but it is not rinsed. It is then worked again for half an hour in a bath containing hydrochloric acid, and afterwards well rinsed. Treatment in a hot soap bath follows, and, again, without rinsing, work in a cold bath of acid, after which the material is ready for dyeing. The successive treatment with soap and then with acid brings about the disposition of a certain amount of fatty acid on the fiber, and has the effect of increasing the similarity of the handle of the wool to that of silk.—*Selected.*

KNITTING

THE NEEDLE IN LOOP WHEEL MACHINES.

DESCRIPTION OF A SPRING BEARD NEEDLE. DEFECTS IN FABRICS DUE TO DEFECTIVE NEEDLES. OTHER CAUSES OF DEFECTS IN FABRICS. BEARD NOT ENTERING EYE. CRAMP NOT UNIFORM. BEARD BREAKING AT CRAMP. BEARD NOT ENTERING EYE TO SUFFICIENT DEPTH. SUGGESTIONS.

(*Contributed Exclusively for* COTTON.)

BY ERNEST TOMPKINS.

The spring beard knitting needle plays a far more important part in loop wheel knitting than is generally realized. A slender wire only two or three hundredths of an inch in diameter and standing up from its support from ½ to ¾ inch, transmits all of the power used in the actual formation of the stitch, including the drawing of the yarn into the machine. In so doing, it travels at the rate of 300 feet per minute, in that time running the gauntlet of 1440 burs each one like the storied Indians giving it a buffet; yet it bravely does its dole of 360,000 stitches braving a million and a half menaces until, exhausted, it drops or inclines slightly, thus getting into the way of a direct blow which puts an end to its three hundred and sixty mile journey.

FIG. 1. DEFECT ON THE BACK SIDE.

If all of the needles in any one machine were alike, whatever effect these needles had on the cloth could not be told by comparison but, whereas needles are never exactly alike, these effects are determined by comparison. The rule for locating these characteristics is, that vertical effects are due to differences in the needles. This rule is more reliable than is generally the case with knitting rules. Among the exceptions to it may be noted, effects due to the edge of the needle cylinder, such as oil spots or nicks, and effects due to the takeup, such as cuts at the spreader, which would occur in vertical lines, but, of course, can not occur until after the takeup is reached. Both of these are easily located, so the rule may be generally accepted that vertical effects are due to differences in the needles. Moreover, these effects are generally vertical lines either continuous or somewhat broken.

Illustration No. 1 shows on the extreme left, a broken vertical line and nearer to the middle two spots will be noticed, which are part of a broken vertical line; whereas illustration No. 2 shows a practically continuous vertical line. Inasmuch as faults of this kind do not generally appear in the fabric as it is put on the market, since fabric with such defects would hardly pass even as seconds; the faults may best be considered in the knitting room on the machine where they are made. When the operator observes a flaw occurring in a vertical line he should at once stop the machine and trace the line down to the needle at the bottom of the wale in which the defect is located. The natural inclination seems to be to break off the beard of this needle and replace it with another one without investigating the cause of the trouble. Indeed it may be that the operator has no other course to pursue, since the main requirement may be to keep the machines running as much as possible; but it would be to the interest not only of the operator but to the mill as well to determine the exact cause of the trouble before undertaking to apply the remedy, for at present the knitting trade is largely dependent on what the operator learns at his work and without sufficient time and inclination to learn there, the opportunity for improvement is small indeed.

Referring again to illustration No. 1, this shows the back of a piece of 20 gage webbing made of 2/20s worsted and a couple of leaded needles of the kind on which it was made. The needle in the foreground is the one which caused the drop stitches on the extreme left. The point of the beard of this needle is very close to the shank. The stitch of the fabric is comparatively long because the yarn is heavy for the gage; moreover being worsted yarn, it will shrink in the washing consequently the stitch should be long or the washed fabric will feel "boardy."

The broken line of drop stitches is a good illustration of a defect which puzzles many an inexperienced knitter. It affords also a good opportunity for the exercise of both observation and reason. Since the effect is in a vertical line the needle must be responsible for it, but more than that, since the effect does not occur constantly at every stitch in the wale some influence outside of the needle must be exerted. Such is really the case. The point of the needle beard is rather low for the thickness of the yarn that has to pass under it. Moreover, the stitch being long, the entering blade of the loop wheel grazed slightly against this beard thus closing it so that the entering yarn came up outside of the beard instead of passing under it.

From the illustration it would look as if this occurred at every course for about fifteen and then stopped only to begin again for about as many more. In reality, however, the beard was probably closed only twice, that is, at the bottom of each section of drop stitches. The other drops were caused by what is called a "run-down"—really a "run-up." In support of this theory that only two drops were made at the needle, is the showing made by the two spots in a vertical line near the middle of the illustration. These were made by a different needle than either of those illustrated. This was a needle, the beard of which was not

quite as low, so that instead of the new yarn going entirely outside of the needle beard, it was split; most of it going on the outside and the balance going inside, making a partial tuck instead of a complete drop.

The question may arise: Why was not each of these beards pressed down by every blade which touched it? The answer is that the blades, like the needles, are never absolutely straight since they have to be hardened, consequently the spaces between the blades vary slightly, the result being that the beard will be touched more or less lightly by different blades so that the amount that the beard is closed thereby will not be constant.

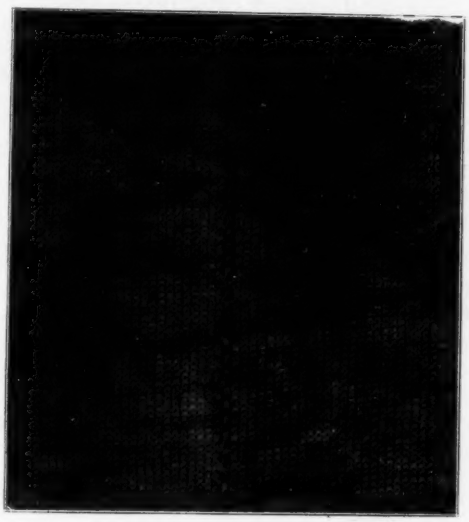


FIG. 2. VERTICAL LINE DEFECT. FACE SIDE.

Still more than this, the lack of uniformity in the yarn has something to do with the defects illustrated. Where the yarn is heavy it is more likely to be split on the needle beard than otherwise, since it can not pass through as narrow an opening as the lighter yarn.

Illustration No. 2 shows a practically continuous vertical line. This illustration is of the face of two-thread 26 gage webbing. The face thread is worsted and the back thread is cotton. The defect was too long for complete illustration so the lower part has been cut off. This lower part, however, was just like that illustrated, except about three times as long and it ended just as it began; that is, the needle reformed and continued to knit properly just as it had been doing before it began tucking. This also is somewhat puzzling to the beginner and illustrates an outside influence; otherwise the needle would not have reformed but would have continued tucking until the beard dropped off which is the case of most frequent occurrence. This illustration was selected because of its comparative infrequency and because of the intermettence of its imperfection, as it will be noticed that with fairly good regularity one loop is tucked in succession.

What actually happened is that a seed or moat lodged in the head of the needle. It will be obvious that if this moat were a splinter sticking out pretty well on both sides of the needle no stitches could be cast therefrom, because this splinter would hold every stitch on the needle until something broke. It happened, however, that this moat was just sufficiently long to hold two loops and no more, so that it dropped its load every second course with considerably good regularity. Finally, the moat dropped out from its resting place and then the needle returned to its former proper operation. This kind of a defect is practically unavoidable and is especially annoying in worsted work in which moats and burs are frequently encountered.

Illustration No. 3 shows the same kind of work as illustration No. 1 and is presented here to illustrate the vertical line of partial tucks on the right hand side of the illustration. This line was caused by a low beard which split the yarn just enough to roughen the back of the goods without making a hole or a perceptible tuck. It did, however, make a flaw in the face of the goods. At the upper part of the illustration will be noticed a few floated threads. These went up over the beards not through any fault of the latter, but because the guide was too high. The thread on the extreme left caught on the nose of the stationary presser and was broken.

From the foregoing, the reader should be able to trace faults due to defective needles. It remains to state what some of the most important defects are.

BEARD NOT ENTERING EYE.

It has been previously shown how two outside influences may make the needle tuck. However, any cause which keeps the needle beard from entering the eye so that the old stitches can not be slipped up over the beard will make tucks. In general this trouble may be due to three different causes: improper construction of the needle, improper placing of the needle, improper pressing.

The needle beards are closed into the eye by what is called a presser. This may be revolving or stationary, but in every case there is a tendency to push the beard backward in the direction of motion as well as inward. The better the presser is, the more directly inward will be its thrust. The backward pressure is increased with small

FIG. 3. DEFECTS ON THE BACK SIDE.

diameter in the ordinary round presser; and in the stationary presser, with bluntness of the toe or with anything which increases the friction, such as insufficient lubrication, poor lubricant, rough material, insufficient hardness, insufficient polishing, etc. New stationary pressers frequently give trouble when first started, which trouble may be overcome by ample lubrication until the beards have polished the presser enough to eliminate the excessive friction. Old stationary pressers cause trouble by becoming roughed at the heel where the needles vibrate under the

labor of driving the lander, making the wear uneven on the presser, so that the heel is worn in a wavy line instead of a straight one. This may be overcome by removing the presser, grinding and repolishing.

Improper construction of the needle, so that the beard will not enter the eye, will cause tucks. The eye may be punched too high or too low or to one side, or the beard may be turned to one side.

Improper holding of the needle, causing tucks, consists of having the needle rotated so that the presser can not close the beard into the eye. With leaded needles this fault is generally due to a mold trick which has too large an opening so that the needle beard rocks in the trick, or has too small an opening so that the beard is cramped and turns partially over when it is placed in the mold. This rotation of the needle also occurs with trick needles, but in such case it is almost always due to improper construction of the needle, either one of the defects mentioned above or failure to bend the crank in the same plane with the beard and the eye.

CRAMP NOT UNIFORM.

It is customary, in loop wheel knitting, to cramp the needle beard, that is, to bend a mid portion of the beard sufficiently close to the shank to keep the yarn from falling out or from changing its position, thus spoiling the uniformity of the loops. When the needle is not cramped it is called an "open" needle. It is obvious that if the mid portion of the beard were closed right down onto the shank the yarn could not be placed up under the beard into the head of the needle without springing the beard upward to let the yarn pass. It would require some force to do this, consequently an increased load is put on the sinker bur if the cramp is too great. Indeed it frequently happens that much trouble is caused by too much cramp in the needle.

It may happen that a knitting room which had been running in good shape, shows increased waste due to holes made on the machine, yet no one will know where the trouble is. Indeed, it may be contended that there should be no trouble because there has been no change from the previous conditions which gave good results. But later it is discovered that a new lot of needles, ordered from one of the old needles as a sample, has slightly more cramp than the old needle. A very few thousandths of an inch in the cramp may make many dollars worth of increased expense in the knitting room.

If the cramp is too much, but the needles are all cramped alike, the trouble will not be as apparent in the cloth as it will be in the working of the machine, especially of the sinker bur, which will run less smoothly and push the needles further inward. Moreover, the stitch will not go down as readily at the push-down, so that the latter may have to be adjusted lower or closer to the needles. It is generally the case, however, that the cramp is not uniform and if it be too great the cloth will give evidence of it by vertical lines, due to some needles forming longer stitches than others. Bearing in mind that the loop is formed by two blades pressing the yarn against a needle, it is evident that if this needle pinches the yarn before the loop is entirely formed, it will draw a longer loop than it should. This is actually the case, the needle with too much cramp stealing the yarn from the loops of the adjoining needles. If there are only a few such needles in the cylinder the trouble is overcome by replacing them or by lifting the beards either with pliers or by forcing up under them a narrow strip of tin or sheet steel of the proper thickness.

BEARD BREAKING AT CRAMP.

It sometimes happens that the needle is so constructed, that it breaks near the cramp instead of at the head which is supposed to be the proper place. When it breaks at the head, the stitch is dropped, forming a run-down into which the point of the stop motion enters, thus stopping the machine. If, however, the needle breaks near the cramp, a hook is left, which receives a loop at every sinker but refuses to unload any of them, thus accumulating such a quantity of tuck stitches that this particular needle is pulled inward under the stress, thereby putting it in the way of causing a smash. It sometimes happens that a knitting room may be almost entirely tied up by a lot of needles of this kind.

BEARD NOT ENTERING EYE TO SUFFICIENT DEPTH.

If the eyes is not sufficiently deep or if the point of the beard is too blunt, the old stitch may be obstructed as it is pulled upward by the lander. In this case, some of the fibers of the yarn will be pulled out or cut, or the yarn may be broken entirely. This trouble is not readily located and may cause much annoyance.

SUGGESTIONS.

Good judgment dictates that the knitting room should be supplied with a micrometer, a magnifying glass, and some little strips of steel for testing the cramp of the needles. If the management will not supply these, the knitter should procure them himself for his own protection, because it not infrequently happens that a knitter may get into so much trouble that he has to retire, whereas if he had the tools described and used them with even ordinary judgment, he could have located the trouble in the needles or perhaps in the bur blades and thereby have retained his position, thus saving far more than the cost of the tools. Every lot of needles and every lot of bur blades that comes into the knitting room should be measured with a micrometer and inspected with a magnifying glass before permitting any of them to be used. A poor lot of needles in the cupboard is harmless, in the machine it is harmful.

KNITTING MACHINERY IN JAPAN.

(*Written Expressly for* COTTON.)

The growth of this industry in Japan dates back to 1903. At that time comparatively little attention was given to the manufacture of knit goods, the total cost of machinery purchased through Kobe amounting only to $877. In 1907, supplies were purchased by knit goods manufacturers to the value of $37,004 for the Consular district in which Kobe is situated, which, however, dropped in 1908 to $19,605.

The United States made no sales until 1905 when machinery valued at $409 was disposed of. The following year this was increased to $6,477 and in 1907 to $10,682, but in 1908 dropped to $2,701. The only exporting nation making a gain that year was France, its increase being due to the attraction of large loans secured by several Kobe and Osaka concerns.

The following table tells the story for the past five years:

Imports of Knitting Machines to Kobe by Countries.

	1908	1907	1906	1905	1904	1903
Belgium	$....	$ 124	$.....	$....	$...	$ 33
France	1,732	1,348	739	....	...	131
Germany	3,672	9,976	2,267	1,032	...	301
Great Britain	1,600	3,018	1,544	2,267	726	412
United States	2,701	8,292	6,477	409	...	...
Italy	....	569	.....	....	...	...
Totals	$9,705	$23,327	$11,052	$3,708	$726	$877

Imports of knitting machines to Osaka by countries.

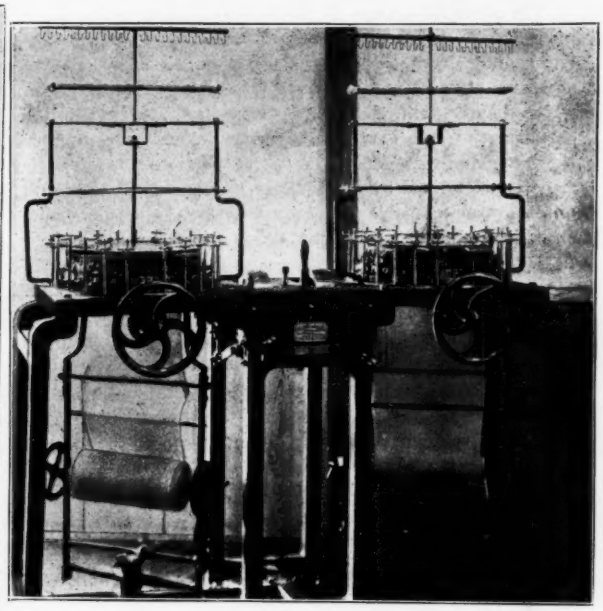
	1908	1907	1906
France	$9,691	$8,861	$7,953
Great Britain ...		372	.....
Germany		530	1,030
Switzerland	209	1,524	1,030
United States ...		2,390	.....
Totals	$9,900	$13,677	$10,013

It was stated in a report from the Consular district mentioned above that there are 1300 manufacturers and dealers of knit goods in Osaka alone. It may be explained that several hundreds of so called manufacturers own hand machines and operate them in their homes. There are, however, a number of large concerns where the various types of machinery are used.

The accompanying photographs show the hand and power machines turned out by the Nishio Knitting Machine Factory, Osaka. The larger machine turns out 132 pounds and the smaller one 66 pounds per day. The prices of Japanese made machines are as follows:

4 feet	16 threads	$ 23.40	10 feet	24 threads	$ 42.50
5 feet	18 threads	27.00	11 feet	24 threads	45.00
6 feet	18 threads	29.50	12 feet	28 threads	50.00
7 feet	20 threads	33.00	13 feet	32 threads	52.50
8 feet	24 threads	37.50	14 feet	36 threads	55.00
9 feet	25 threads	40.00	32 feet	80 threads	140.00
40 feet	100 threads	215.00	15 feet	26 threads	60.00

JAPANESE HAND KNITTING MACHINES.



JAPANESE POWER KNITTING MACHINES.

The prices of hosiery machines are:

160 needles	$8.00	140 needles	$7.00
120 needles	6.50	100 needles	6.00
80 needles	5.50		

Two of the best known producers of knit goods in the Kobe district are Messrs. Yagifuku & Co., and Idzuoka & Co., Osaka.

The total output of machines manufactured in 1908, numbered 350

DYEING, BLEACHING AND FINISHING

CHEMICALS USED IN THE TEXTILE INDUSTRY.

BY DR. FREDERIC DANNERTH, CONSULTING INDUSTRIAL CHEMIST.

These lectures were delivered at the Kensington Institute of Philadelphia during the Winter of 1908-1909.

(*Reported Exclusively for* COTTON.)

Lecture IV.

COTTON SOFTENERS AND WOOL OILS.

The term cotton softener or "softening" is applied in trade to a variety of mixtures which are intended for use in those processes which have a tendency to render the cotton fiber harsh. Chief among these are the dyeing of sulphur black, the dyeing of aniline black and the bleaching of cotton with chloride of lime. The character of softeners may be inferred from the use to which they are put. They are used on loose stock, as well as on yarn in the form of skeins, warps, and on hosiery.

A large number of softeners consist of an emulsion of oil in a concentrated solution of soap, but the little attention paid to this subject by the dyers has led unscrupulous supply houses to make up pastes of equal weights of hard soap and water. The fancy prices obtained for these preparations have amply repaid the ingenious dealer for the trouble which he has taken to prepare them. In addition to the soap and oil, some softeners contain small amounts of glycerin which really assists in giving the fibers a soft "feel." Substances such as waterglass, rosin, starch and clay when present in softeners must be put down as adulter-

ants pure and simple. Their chief mission is to add weight for which the dyer pays from 4 to 8 cents per pound.

One mode of preparing softeners is to saponify an oil with half as much alkali as is necessary to completely "cut" the oil. One sample of soluble oil which came to my notice consisted of a solution of castor oil soap in water, while another was made of sulphated olive oil chiefly. Both soda and potash soaps may be used. A soda soap, in which the glycerin has been retained, forms, in conjunction with an oil of low melting point, a softener which is cheap, hygroscopic and which gives the fiber a certain firmness.

The other advantage, to which attention has been called by Burnham, is the prevention of rancidity by the protective coating of solid soap over the oil in the fiber. Potash softeners are soft and remain soft because of the glycerin which they contain. This fact makes it impossible for the soap maker to use hard tallow for the manufacture of potash soaps and softeners. The use of any oil or fat in softeners is determined by its tendency to turn rancid. Mineral oils are unsaponifiable and are, therefore, as a rule, undesirable, except for use on low grade goods.

During a recent conversation with a prominent oil manufacturer, the latter justified the sale of low grade softeners as a necessity, for the reason that many hosiery manufacturers were not willing to pay the price of a high grade article; their excuse being that the cost of manufacturing the stocking was such that little profit was to be had in increasing the expense by the use of expensive softeners. At this point the thought occurs that we are at the present day importing a large amount of superior hosiery for which the consumers gladly pay fancy prices because they stand the wear and have an agreeable feel.

Fish oils are excluded from use because of the bad odors which they produce on drying; and secondly because of their tendency to "gum." Among the many materials which enter into consideration for the preparation of softeners may be mentioned, olive, cotton, corn, palm and cocoanut oils; the fats obtained from beef, mutton and hogs; tallow oil, lard oil, and red oil (commercial oleic acid). In making the choice of an oil it is necessary to consider the cost of the finished "softener," the melting point of the fat, the danger of the oil or fat turning rancid, and the amount of unsaponifiable matter contained in the oil or permissible in the finished softener.

For low grade, loosely twisted or short staple yarns, the soda softener is generally preferred because of the low cost and the weight or body which it imparts to the yarn. The potash softener is recommended for use on material of an opposite nature to that mentioned above. Although there are, as before stated, a large number of "patent-medicine" softeners on the market, there are also a certain number of carefully prepared articles. These latter consist essentially of water and oil thoroughly emulsified with soap dissolved in the minimum amount of water. The amount of oil added should be such that the soap can readily hold it, even when the softener is mixed with the water of the softening bath. If an excess of oil has been added, this will separate and give rise to spots. Of the two methods of preparing softeners, the one in which a previously made soap is used, is for many reasons more desirable. Thus, a palm oil soap may be emulsified with an olive oil or an olive oil soap may be emulsified with palm oil.

One important advantage of this method lies in the fact that the free oil has not been subjected to prolonged boiling. As suitable combinations of soap and oil for the preparation of softeners, may be mentioned: corn oil soap combined with olive oil; bleached palm oil combined with potash-palm soap; commercial oleic acid combined with soda or potash; beef tallow emulsified with potash-cotton oil soap. A non-drying oil, of low melting point, combined with soda in the proportion of three parts soap, one part oil and seven parts water has been found to yield good results.

Sulphonated oils, prepared from various vegetable oils, have of late years been suggested for use as softeners but the price (10 to 15 cents per pound) has limited their application. The analysis of cotton softeners includes a determination of water, dry soap, free oil (saponifiable) and free oil (unsaponifiable). Several commercial samples showed on examination:

	Soda Compound	Soda Compound	Potash Comp.
Water - - - - -	69%	64%	69%
Dry soap - - -	20	27	24
Free oil - - - -	6	9	7
Mineral oil - -	5	0	0
	100	100	100

WOOL OILS.

In the manufacture of woolen yarns, the spinner is desirous of making the fiber pliable, so that there shall be a minimum of friction while the stock is passing through the spinning frames. For this purpose he "lubricates" the stock with oil before spinning and removes this lubricant before the yarn is bleached and dyed. This is accomplished by scouring the yarn with soap water to which, in some cases, a small quantity of soda ash is added. If not scoured thoroughly, the wool will remain greasy, and dye spots will surely appear, because the dye solution is unable to penetrate the layer of oil on the surface of the fiber. In the spinning of worsted yarns on the "French System," little or no oil is used so that these may, in many cases, be dyed without previous scouring.

As wool oils must consist of substances which are easily emulsified we must, at the outset, exclude two important classes of lubricants, namely: wool fats and mineral oils. If the soap solution is strong enough, and some soda ash be added to the liquor, the mineral oil may be removed but its complete emulsification always remains a matter of doubt.

Commercial oleic acid (elaine, red oil or oleine) is eminently suited for a wool oil, as its alkali salts are easily formed and readily soluble in water. It is obtained as a by-product in the manufacture of stearic acid from tallow, and melts at about 57 degrees Fahrenheit. The mixture of free fatty acids, obtained by saponification of the tallow, is chilled and subjected to hydraulic pressure. By distillation in a current of steam, it may be obtained as a colorless liquid of acrid odor and specific gravity of 0.900; sulphuric acid is sometimes present in considerable quantity and is due to the method of saponification.

Theoretically it would be necessary to use 20 parts of soda ash for converting 100 parts of oleic acid into sodium oleate, so that a light scouring with soap and soda will generally suffice for the removal of this material from wool after spinning. It is interesting to note that when ordinary fat is distilled with superheated steam, the distillate which is obtained consists of a mixture of oleic acid with 3 to 7 per cent. of unsaponifiable matter. This seems to be due to decomposition products related to the hydrocarbons. In view of this, it sometimes becomes difficult to state with sureness that the oleic acid has been intentionally adulterated with mineral oil. In general, it may be said that if the unsaponifiable matter is much in excess of seven per cent., there is a strong indication of adulteration.

Olive oil represents one of the most valuable lubricants for wool. It can be readily removed from the fiber by emulsification, but its use is restricted, owing to the high price which it at present commands. The color of the oil varies from pale yellow to dark green; the latter grade being obtained from the last pressings, owes its color mostly to the presence of chlorophyl (leaf green). Olive oil is a typical non-drying oil, which means that it does not form crusts when exposed to the air and light and does not thicken materially after long exposure, but gradually turns rancid. The average specific gravity of the commercial article varies from 0.914 to 0.917.

Lard oil, obtained from hogs by cold pressing, is the only animal oil which has been used up to the present time in this branch of textile manufacture. Commercial lard oil is not open to any objections. However, it is frequently admixed with the cheaper mineral and vegetable oils. Such mixtures can not be properly removed from the yarn by the usual scouring agents without injury to the fiber. Wool oils should contain only a very small percentage of unsaponifiable matter, in fact, those intended for high grade stock must be free from such impurities; they must furthermore be of the "non-drying" class, for materials like cotton oil and linseed oil would gum in the cards and thus cause no end of trouble.

Reclaimed fat ("scouring grease," "reclaimed oil") has for years been offered to spinners as a substitute for the more expensive products. These greases are in some cases obtained by treating the wash waters from the scouring of wool with a mineral acid, whereby a mixture of wool fat and fatty acids is obtained. This yields, on distillation, a mixture of fatty acids, hydrocarbons and cholesterol, the two latter constituents being unsaponifiable. I need hardly remark that such lubricants are not to be recommended for first class stock, for the amount of unsaponifiable matter may vary from one to twenty per cent.

Two typical analyses of these "reclaimed oils" are given below:

Free fatty acids	....84 per cent.	55 per cent.
Unsaponifiable matter	. 4 per cent.	38 per cent.
Esters (combined fatty acids)	.....12 per cent.	7 per cent.
	100 per cent.	100 per cent.

The first sample was pale brown in color, of a semi-solid consistency and had a specific gravity of 0.9045.

NOTE: The wool oils discussed in this lecture must not be confounded with the wool fat which is present in raw wool when it is clipped from the back of the sheep.

TURKEY RED OILS.

The term turkey red oil is at present applied to a large variety of products, all of which are prepared from vegetable oils by sulphonation with sulphuric acid at temperature not above 95 degrees Fahrenheit. The material used for the manufacture of the genuine product is castor oil; but olive oil, cotton oil, cocoanut oil and rape oil also find extensive use for these purposes.

The chief constituents of genuine turkey red oil are Ricinoleic acid, ricinol-sulphuric acid and oxy-oleic acids combined with soda or ammonia. The value of the article is materially enhanced by the presence of sulphonated fatty acids, although some commercial samples are found to contain very little, if any, of these compounds. After treating the castor oil with concentrated sulphuric acid, the mixture is allowed to stand for several hours; then washed and afterwards neutralized with ammonia of caustic soda. Para Soap, P. N., which is recommended by the Hoechst Color works for use in the dyeing of paranitraniilin red, is prepared by partial neutralization of the ricinoleic acid with ammonia. Tournant Oil, a material formerly used in the old-style-process for turkey red is not a sulphonated oil. It is prepared from somewhat unripe olives which are steeped for some time in boiling water before being pressed. Such oil soon turns rancid and can then be used for preparing the emulsion for the dyeing process.

THE THIO-INDIGOS IN MECHANICAL APPARATUS.

For a number of years the use of specially adapted machines for the dyeing of cotton has gradually extended, and the influence of the excellent proportion of fastness of the sulphide dyestuffs and their adaptability to this means of application have had appreciable effect. No great difficulties are in the way of reaching by this method almost any shade and the highest degree of fastness, though reds and pinks, fast to light and washing, are difficult to attain. So far, alizarin has secured very little use because of the difficulties attending its application and the need for specially arranged contrivances. Consequently, when reds and pinks of the utmost fastness are required, the yarn is usually dyed in the hank or warp form.

The appearance of thio-indigo red and thio-indigo scarlet on the market alters these conditions, for by using either of these, the desired shade of red or pink may be obtained in a simple way by dyeing the material in the form of cops, cross-spools, or hanks in machines.

These colors are applied in a vat, and the material then submitted to the influence of oxidation. The dyeing, therefore, may be carried out on any form of apparatus which admits of bringing about this oxidizing influence without having to remove the material from the machine for the purpose. This course is possible with all those machines provided with a suction pump or partial-vacuum creating arrangement, by which all the dyeing liquor can be removed, when desired, from the vessel. The cotton under evaporation is then oxidized by causing the rapid passage of air through it. Carried out in machines which are not provided with means for draining off all the dye-liquor, the application of these dyestuffs is not as satisfactory, for after dyeing, the material needs to be removed from the apparatus, hydro-extracted, and the development of the color left to the gradual effect of the surrounding atmosphere.

Both cops and cross-spools have been dyed with equal success with these dyes, as well on unboiled-out yarn as on yarn that had first been boiled out. Those machines, provided with means for creating a partial vacuum, are specially adapted for taking the material without having been previously boiled out. The vat liquor is made up according to the general recipes. The brightening of the shade may be attained along with the complete development of the color by giving a weak bath of hypochlorite solution. Increased brilliancy may be obtained by topping with 0.1 to 0.2 per cent. of rhodamine 6G, without in any way decreasing the fastness of the shade to washing. Thio-indigo scarlet R and thio-indigo red have special interest for works concerned with the production of alizarin pink by machine-dyeing, because of the many grave difficulties connected with the latter.

A very important advantage is to be gained by substituting these colors, dyed from machines, for the much more expensive practice of dyeing with alizarin in the hank

form; the cost of winding is saved, and much less waste is produced. The sum of these advantages has been calculated to represent a saving of 2½ to 3 cents per pound of cotton in favor of the thio-indigos against alizarin.

An example is cited of the production of a medium pink from a combination of the two kinds. For 220 pounds of cross-spools, the dye-liquor contained is made up with 200 gallons of water, 186 degrees Fahrenheit; 20 pounds Glauber's salts (crystals); 7-10 ounces hydro-sulphite powder; and .2-.3 gallons caustic soda, 70 degrees Tw., and the whole well mixed together. After standing for about half an hour, this bath is circulated through the yarn in the machine for fifteen minutes, when there are added 17 gallo of thio-indigo scarlet R, hydro-sulphite—stock liquor 1: 10, and .2 gallons of thio-indigo red B—hydro-sulphite—stock liquor, 1: 10. The vatted liquor is circulated through the material for three-quarters to one hour, when the material may be extracted and aged. Should the shade not turn out deep enough, the yarn must be returned to the machine and deepened with a correspondingly weaker bath.—*Farber Zeitung.*

Practical Problems Discussed by Cotton's Readers.

Discussions of Mill Problems are Solicited for this Department.

POWER CONSUMPTION OF THE SPINNING FRAME.

EDITOR COTTON: When one stops to think that the spinning frame spindle is the largest consumer of power in a cotton mill, the wonder is that more attention is not paid to this part of the frame. The average spinning spindle consumes from 40 to 80 per cent. of the power put into the frame.

Good mill men scrub their frames twice during the year, taking out the rolls, cleaning stands, gears, cap-bars, ring rails, rings, etc.; but they too often neglect their spindles. They will let their spindles run for years without cleaning out the bases and bolsters, with the result that they get "gritty" and foul with dirt. It is this condition that makes the power consumption run up.

In towns and cities where the mill is paying out money to a power-house for power consumed, the wonder is that more attention is not paid to cleaning the bolsters out, at least once a year. It is not sufficient to put a little kerosene oil in once a month or so. It is a good investment to take the bases and bolsters off the frame and clean them, or do as is done in many places; take the spindles out when scrubbing the frames, and clean the bases out with a jet of steam or compressed air.

It is useless to think that the type of spindle you are using consumes the power. One of the largest spindle makers in the world has stated that the different makes of spindles do not account for any large difference in the power required. To use his own words: "Variations in power consumption between different types of spindles of the same general class are slight as compared with the variations produced by improper conditions."

I have records of many mills that are running as low as 36 spindles per horse-power and others on the same numbers of yarn, running 48 spindles per horse-power on spinning frames. The former, of course, are in mills where no attention is paid to the condition of their spindles, while the latter prevails only in mills that pay close attention to this matter.

In a weaving mill, a rough estimate of power consumed is 50 per cent. in the spinning room and 50 per cent. in the weaving and the preparatory processes. This is a fairly true statement on No. 30s yarn weaving 40 inch goods, so that an increase of 20 per cent. in the spinning room due to the poor conditions, means a 10 per cent. loss on the total power. This is an item well worth looking after, as the extra power consumed represents purely a dead loss.

Next to tight bands, dirty spindles are the most costly pieces of mechanism and dirty spindles always mean tighter banding.

If you want low power costs, start a cleaning campaign in your spinning department.—*J. W. Fox.*

FLYER LEAD AND BOBBIN LEAD.

EDITOR COTTON: I wish you would allow me to discuss a few problems that have come up in my career as a carder.

Some years ago, it was the common practice in the slubbing, intermediate and roving frames for the flyer to lead the bobbin, and was known as the "flyer lead." It was found, however, that the flyer started in advance of the bobbin, and by so doing made a weak place in the roving. In order to remedy this, the system was altered and the bobbin made to lead, in the belief that the flyer would still start first and only cause a little slack, which would soon be taken up and do no harm. Was this belief correct?

I will try to explain the reason why the flyer started in advance of the bobbin, in the "flyer lead," and show if the alteration has proved to be a remedy, and if not, what effect does it have?

The reason why the flyer starts ahead of the bobbins is that the revolution of the bobbins is transmitted through a greater number of gears than the revolution of the spindles and consequently to the flyers. The actual number of gear wheels in the train to the bobbins is nine, while there are only five to the flyers. It follows, therefore, that the flyers will start before the bobbins, owing to the sum of the "backlash" in the nine gears driving the bobbins being greater than that of the five gears to the flyers.

It may be said that owing to the flyer starting first, and the velocities of the bobbins and spindles at the instant of starting not being in the required ratio, the roving will be stretched. And here it may be permitted respectfully to differ from several recent works on cotton manufacturing, the authors of which seem, in the opinion of the writer, to have the wrong theory as to the cause of the flyer starting in advance of the bobbin. In the works referred to, the non-positive factor in the motion of the bobbins or the slipping of the belt, driving the cone drum, is given as the cause.

It will be both interesting and instructive to examine

this question in detail. Consider for a moment what happens when a frame is doffed.

The bottom cone is raised, which causes the sun wheel to stop and no winding on of the roving takes place. The following calculation will show that winding can not take place when the bottom cone is stopped. A 42 gear on the frame shaft drives a 42 gear on the spindle shaft, and a 55 gear on the spindle shaft drives a 22 gear on the spindles. The revolution of the frame shaft per minute is 517. This gives

$$\frac{517\times42\times55}{42\times22}=1297.5 \text{ revolutions per minute}$$

of the spindles.

Now when the sun wheel is stationary after the stopping of the bottom cone, it ceases to be a factor in the motion of the bobbins, and the only motion they could have is acquired directly from the frame shaft, which has a constant revolution. We may thus find the revolutions of the bobbins as follows:

The revolution of frame shaft per minute is 517. A 56 gear on the boss of the loose bevel drives, through two carriers in the swing, a 56 gear on the bobbin shaft, and a 55 gear on the bobbin shaft drives a 22 gear or bobbin wheel. Then the revolutions of the bobbins are

$$\frac{517\times56\times55}{56\times22}=1297.5 \text{ revolutions per minute}$$

of bobbins.

These are the revolutions of the bobbins per minute, without the agency of the differential motion. From the above, it is evident that under these circumstances the bobbins and the spindles both have the same number of revolutions per minute.

Now suppose at the time of doffing, the bobbin is four inches in diameter, then its circumferential velocity will be

$$\frac{1297.5\times4\times22}{7}=4{,}077.5 \text{ inches per minute.}$$

Now, the foot of the flyer presser, being by centriptal force in juxtaposition with the periphery of the bobbin, it will, in one revolution, describe a circle having a radius equal to the radius of the circle described by the periphery of the bobbin. Therefore, the circumferential velocity or the space described by the flyer presser and the periphery of the bobbin will be the same, and consequently no winding can take place.

As a corollary to the above, we should say that the slipping of the cone belt on starting the frame would tend to ease the roving rather than stretch it, whether we have the bobbin or the flyer leading. So that the reason previously given is the only cause of the stretching of the roving.

In considering the second section of the question, we must remember that when the flyer is leading, the winding is accomplished by the velocity of the flyer presser being greater than that of the periphery of the bobbin. This difference will be better understood by an example. Say the front roller delivers 500 inches of roving per minute, then taking the circumferential velocity of the bobbin at any time at 4500 inches per minute, the flyer presser must pass through a space of 4500+500=5000 inches per minute, and as explained previously, the flyer starting in advance of the bobbin, it will cause the roving to be stretched.

In frames which have the bobbin leading, the converse arrangement to the above is adopted. The bobbin has to take the roving from the flyer presser, therefore its circumferential velocity must be the same as the latter, plus the velocity of the front roller. This being the case, it follows that in bobbin leading frames, the flyer starting in advance will cause a little slack, which will be taken up when the full velocity of the bobbin has been attained. The alteration has certainly remedied the stretching of the roving and has also eliminated another minor evil. When an end would break in the flyer lead, the flyer would be unthreaded, thus making waste and losing time. This does not occur when the bobbin leads. After considering all of the points I believe that the frames which have bobbins leading are admittedly the better.—*M. E. Bean.*

THE CLOTH ROOM.

EDITOR COTTON: I will endeavor to give you my ideas about the cloth room. The first qualification for a cloth room overseer is that he be acquainted with all of the processes of cotton before it gets to the loom. He can then more easily tell good cloth from bad and can also more easily tell the causes of defects, light and heavy weights, etc. He should also be acquainted with the weaving of cloth.

The first handling of cloth after it enters the cloth room from the weave room, is the inspection, which is a very important matter. The man who inspects or classifies must be a true, honest man with no special friends or pets in the weave room.

Special care should be taken to keep the cloth clean and the machine (cloth cleaner) should be kept in good repair in order to clean the cloth thoroughly. Special attention should be given to the rolling of rolls and folding of bolts, in order that the ends may be perfectly even.

Branding of duck is a very important matter. The duck should not be blurred with the stencil or stained with ink and the branding should be done in uniform lines and in deep colors. Great care should be given to packing the cloth and branding the bales.—*Cloth Room Overseer.*

QUESTIONS ABOUT A SLASHER.

EDITOR COTTON: I want to ask a few questions on slasher work and hope to see them answered in your paper by the readers.

1. In making sizing out of corn-starch, tallow and alum, how much of each should be used to one gallon of water?
2. How long should the sizing be boiled before using?
3. Should the sizing be boiling hot or not when the yarn is going through?
4. How much flannel should be used on the squeeze roller?
5. How should the lease rods be set to divide the yarns in order to get the best results?
6. Can you put too much cloth on the friction roller or not? If so, what effect does it have?
7. Should you change any threads from one dent to another in the comb while running a beam?
8. How much steam should be used on a slasher for drying the warps?
9. How much draught should there be, if any, to carry the steam from the cylinders?—*Slasher.*

The Mill Situation North and South; Market Review.

NEW ENGLAND MILL SITUATION.

Special Corespondence.)

A strong market continues for coarse and medium cotton goods with prices ruling generally higher. Fine goods mills are having a better run than the previous month and conditions appear to indicate that this class of fabrics will soon be in active demand with the firmer undertone to prices. Weaving yarns are in better request at firm prices. Machinery builders and dealers are well satisfied with the improvement in the textile industry and report a very satisfactory market for their wares. Mill stocks hold firm at best prices.

The feature of the cotton goods market in New England during the month of June was the very active market for print cloths. During the first week in the month 625,000 pieces were sold in Fall River, which is the best week since the panic. Mr. Borden bid 3⅜ cents for regulars in any quantity for July, August and September deliveries and only got about 65,000 pieces, but upon raising his bid to 3 7-16 he cleaned the market of about 100,000 pieces. Wide goods became more active in the Fall River market and standard spots rose to 5 cents while futures sold freely at 4⅞ cents.

The more settled weather that developed the latter part of the month encouraged jobbers and retailers to move more goods and did much to brace the market for fabrics, more particularly fine goods which have picked up considerably since the middle of May. The leading tickings are selling at a premium for spots, with a small stock on hand. Thin wash goods are slightly dull because of the heavy accumulation, but jobs of batistes and goods of that nature are being picked up at the slightest concession.

Denims are very strong, in fact, the demand is greater than for 18 months and prices will be advanced about the first of July, it is stated. Mills making ginghams are sold into the early winter months at prices that net a splendid profit on cotton purchased when the contracts were taken but not very large if based upon the present price of raw cotton.

Tickings, drills and plain brown and bleached sheetings are urm at best prices with an upward tendency as time goes on. Tickings are particularly strong with contracts placed for far months delivery at the price of spots. Amoskeag tickings are having a great run in the West and the spot market is bare. Drills hold at the high level. Bleached and half-bleached sheetings have been advanced twice during the month. There have been sales of about 10,000 bales of 3.50 sheetings for export to the Red Sea trade at 5¼ cents. The season on spring ginghams opened the first of June and large orders are reported for Renfrew tickings.

The export market is quiet. China has been taking a few sheetings and drills, but as this is between seasons in the Orient there will not be much heavy buying until the middle or latter part of July. Chinamen are getting a line on our prices and frequently test the market by offering an eighth or one-quarter under current quotations. The South American trade is watching our market closely and many very large contracts have been placed for early fall deliveries.

President Wood of the American Woolen Co. announced that the prices on the goods opened the third week in June and those of the complete opening in July, are the highest ever quoted by the company, because of the greatly increased cost of raw material. Notwithstanding this fact they are based on a wool cost considerably lower than now prevailing and any change of prices will be upward. Customers are protected against a reduction of their spring 1910 prices until the opening of the lines of the fall of 1910 season.

A director of the Amoskeag Mfg. Co. of Manchester, N. H., the largest cotton mill in this country, called the writer's attention to the fact that this concern does a gross business of $18,000,000 per annum and one-third of this or $6,000,000 is worsted goods.

Among the New England cotton mills there is a great deal of new construction going on. The writer was told by a director of the Everett Mills of Lawrence, Mass., makers of Everett Classics, denims, etc., and under the same control as York Mfg. Co., that they had placed an order for about 1,000 Northrop looms to be installed the latter part of this year. They are building a new mill directly west of the present plant. The contracts for the Reciprocity Cotton Mills of East Boston, Mass., will be placed the first week in July. It is understood that Walter H. Langshaw of the Dartmouth Mills of New Bedford, Mass., will be a director with Eugene N. Foss, General Draper and Robert Burgess of Pawtuckett, R. I. William Whitman, who has recently sold his interest in the Whitman Mills of New Bedford, Mass., is placing among his friends, stock of a new cotton mill that he proposes to build at New Bedford this winter. The mill is being planned for 3,000 looms. No public announcement has been made as yet. It is stated that William Whitman has given orders to Arlington Mills at Lawrence, Mass., to throw out all of the old looms and make preparation for new looms to be installed next year.

Draper Co. advertise that they are sold up to the first of 1910. One of the officers of Draper Co. told a mill agent last week that they could not accept but a few large contracts for looms and promise better than first of February delivery. Small orders could be delivered before the end of the year. Other departments of this great textile machinery plant are working full time and buried with orders. Draper stock has sold at 155 this last month, or the highest point it has ever reached.

Whitin Machine Works and Crompton & Knowles Loom Works are well supplied with new orders and are sold into the fall months. The Boston Mfg. Co., of Waltham, Mass., are just receiving 500 Crompton gingham looms and are about to place an order for another large lot. Several of the proposed New Bedford mills are to be equipped with Crompton & Knowles looms.

Textile Mill stocks hold at highest prices with very few offerings. Androscoggin has sold up to 210 while Pepperell is holding firm at 312, which is the same quotation for Amoskeag. Other gilt edge stocks are selling at their top prices with only a few shares being offered now and then to settle an estate or let a tax dodger in the State of Massachusetts take his profit of from $20 to $50 per share in a year. In one year Amoskeag has advanced $77 per share, Bates $66.50, Great Falls $60, Pacific $950, on a par value of $1,000, while Massachusetts Cotton Mills has advanced $50 per share and Pepperell $37 per share. Fall River stocks hold firm. New Bedford issues advance at every sale.

SOUTHERN MILL SITUATION.

(*Special Correspondence.*)

June was the month for annual meetings of the Southern cotton manufacturers' associations. The manufacturers of North Carolina met in Charlotte during the latter part of the month, and there were present about 80 prominent manufacturers. R. M. Miller, Jr., was re-elected president of the association. At this meeting there were present several prominent officials of the Southern Railway, among others being the traffic manager. A considerable part of the time of the meeting was taken up with consideration of best methods for securing cheaper freight rates, better treatment in the matter of demurrage and better attention to claims. The allegation is made by manufacturers that rates charged in that state on freight shipments are excessive and discriminatory. In his annual address President Miller devoted much attention to this matter, and declared that unless better rates were secured, the mills would use electricity altogether, and that the railroads would be the losers, in the loss of revenue from hauling coal. He declared that during the past ten years electricity had superseded fifty thousand horse-power of steam alone in the mills of the Charlotte section. Resolutions were adopted asking retail and wholesale merchants of the South to insist that salt, sugar, etc., be shipped in cotton bags. Mr. Miller declared that manufacturers in North Carolina were anxious to co-operate with state officials in the rigid enforcement of the new child labor laws. Curtailment committee was named to look after curtailment in all lines of the trade at times when such policy was desired.

South Carolina manufacturers met in Glenn Springs, S. C. this month, and re-elected old officials. E. A. Smythe, of Pelzer, is president. The meeting was largely attended. In South Carolina, like Alabama, a state factory inspector has been appointed and there has been considerable protest against this departure. One of the leading addresses was delivered by W. H. Gatchell, of the Southern Railway, who outlined many causes for trouble in handling goods, and urged greater care in loading goods in cars at the mills, and more satisfactory methods of marking and addressing shipments. The association went on record as heartily endorsing the co-operative demonstration work conducted by the national government for the purpose of fighting the boll weevil. There are some 1500 demonstration stations in South Carolina.

Considerable interest centers in the coming meeting of the Southern Textile association, to be held at Spartanburg, S. C., on July 3rd. This association which was organized in Charlotte only a few months ago has been growing rapidly in membership. It is non-union in nature and has for its aim the furtherance of the interests of mill owners and operatives. Its membership is composed of mill presidents, master mechanics, superintendents, etc. A. E. Rooney, of Whitinsville, Mass., will read a paper at the meeting on "Carding and Combing." A. S. Winslow, of Clinton, S. C., will read a paper on "Double Carding." G. H. Mayes, of Boston, will read a paper on "The Power of The Press." Other notable characters will be in attendance and the meeting promises to be one of the most interesting yet held.

There is little material change in the yarn markets over the situation of a month ago. Conditions are still unfavorable and prices low. Export business has been better and from this point the outlook is good. With continued good prices for raw cotton it is confidently believed by mill men that market conditions are bound to improve soon.

One of the best posted mill men in the South, who keeps a close eye on the situation affecting all lines of the textile trade, estimates the amount invested in new mills and additions to established plants for the first six months of this year at $10,000,000. He figures that 1,000,000 additional spindles will have been added to the South's spindleage when the year is over, at the present rate, and even more than this if there is a decided improvement of conditions affecting the trade. The new mill construction record for the year, so far, is perhaps better than any previous record for a similar length of time, and since the marvelous progress has been made under the worst of trade conditions, the record is considered particularly significant. It indicates that capitalists have an abiding faith in the future of the industry of the South, and are not to be deterred by a temporary derangement of trade conditions.

COTTON MARKET.

(*Special Correspondence.*)

BY H. & B. BEER.

As a whole, crop prospects have improved to some extent as a result of timely beneficial rains in all sections of Texas. The breaking of the drouth in Texas was offset to some extent by incessant injurious rains in the lower Mississippi Valley, sections of Mississippi not having had such rains since 1872 according to the Weather Bureau, and the rains in sections of Alabama were the heaviest in 25 years. The Government Bureau report which showed the condition of the crop for the entire belt on May 25th, to have been 81.1 against 79.7 last year and a ten year average of 81.4, included all the benefit derived from the rains during the middle of last month in Texas, but did not include the damage done by washing rains and inundation of all low lands in the Central Gulf States. The loss in acreage of 4.4 per cent as reported May 25 by the Government has probably been made larger by the abandoning of additional land in the bottoms of Louisiana, Mississippi and Alabama, owing to the floods and foul condition of the fields. Therefore, all things considered, recent favorable weather in Texas and the South Atlantic States, unfavorable weather in other sections of the cotton region, coupled with a probable further acreage reduction of about 1 or 2 per cent. in addition to the original estimate of 4.4 per cent. by the Government Bureau, it is probable that prospects for the new crop are no better, as regards the season's probable yield, than they were prior to the breaking of the Texas drouth. In the first place Texas is without sufficient moisture in the ground to assure a full crop, and unless alternating rains be the rule in the state this summer, and many districts are again complaining of the want of rain, there will be another crop scare that will probably be reflected in a higher market. In the second place there is less acreage than last year by about 1,500,000 to 2,000,000 acres, which, irrespective of weather condition of the future, probably means a loss of at least 500,000 bales on last year's production of about 13,600,000 bales.

Conditions in Texas by districts show how backward the crop is in the early producing sections of the state, southwest Texas being 27.8 per cent. worse off than last year, middle west Texas 25.7 per cent. less favorable and south Texas 15.4 per cent. lower than one year ago, while the state as a whole is 5.8 per cent. less promising than in 1908. From what we can gather the movement of new crop cotton from the southern half of Texas is going to be very

late in arriving in quantities of any magnitude, and as available stocks of old crop cotton in the South are being rapidly reduced, owing to light receipts and heavy shipments for export, the spot situation will probably rule very firm during balance of the season. There has been a decided improvement in the tone of the cotton goods markets and in the demand for goods notwithstanding prices to be steadily advancing, and we are of opinion that higher quotations are yet to be witnessed. The agricultural interests of the West and South were never in better shape, and the abnormally high prices demanded for grain and provisions and the fair price being paid for cotton, almost assures general prosperity throughout the country the coming season, and all industrial centers of the North and East will share in the improvement by feeling the beneficial effects of the increased buying power of the rural districts. If a July-August drouth overtakes Texas, all hope for a full crop will have to be abandoned. Therefore, we are of the same opinion still, that cotton bought on all easy periods will probably continue to prove profitable, for in event of Texas experiencing a hot, dry summer much excitement might be had in cotton.

NEW MACHINERY AND TRADE NOTES

IF YOU LOOK FOR IMPROVEMENT in sizing and finishing, or meet with any difficulty in this respect, the Arabol Manufacturing Co., 100 William Street, New York, are prepared to help you. Scientific specialization, long and extended experience, modern facilities in factory and laboratory have prepared them to cope with every requirement. Their progressive spirit, which makes them add continually to their staples, has made them so successful with the textile trade.

CASSELLA COLOR CO. has issued a card No. 2971 on Dyestuffs for Union Dyeing (cotton and wool), in which different methods are given according to the result desired. An extensive list of Diamine colors to be used for union dyeing is given, with small samples to illustrate. There are four groups of dyes shown, as follows: Group I: Diamine colors dyeing wool and cotton almost the same shade. Group II: Diamine colors which dye cotton more than wool. Group III: Diamine colors which dye wool more than cotton. Group IV: Neutral dyeing wool colors.

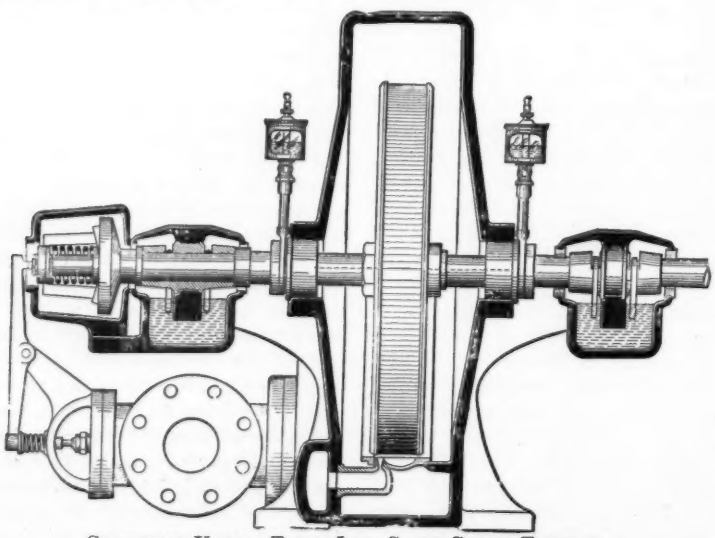
THE TERRY LOW SPEED STEAM TURBINE was described in the June issue. It was mentioned in the article that the distance between the bearings of this turbine is so small that troubles due to whipping of the shaft, etc., are negligible. The positions of the bearings are clearly shown in the accompanying illustration which is a sectional view.

SEYDEL MFG. CO., Jersey City, N. J. Following close on the change of the Atlanta Compound Co. into the Seydel Mfg. Co., and the removal of its headquarters to Jersey City, this progressive concern announces the opening of an Eastern Branch in Boston, Mass., which will be in charge of Mr. Chas. C. Buckley. The first report received about its well known *Sizol* from an Eastern mill was to the effect that "the result was amazing." It reports a steadily increasing demand for its goods and is planning to erect an additional plant as soon as its Northern milling force is well organized.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., has issued a circular No. 1502, which contains much valuable information on alternating current distribution; covering transformers, lightning arresters, insulators, crossarms, etc. Considerable space is devoted to underground and overhead construction, applicable to congested and scattered districts. There is also given information on potential regulating systems. The circular contains 52 pages of information of value to any central station man or any other connected in any way with the distribution of power by alternating current lines.

TEXTILE SCHOOL.

We are in receipt of a number of samples of cotton fabrics designed and woven by students in the textile department of the North Carolina College of Agriculture and Mechanic Arts.



SECTIONAL VIEW.—TERRY LOW SPEED STEAM TURBINE.

The samples show very careful work and are a credit to the College and students.

During the past year, knitting machinery has been added to the textile equipment which makes the College one of the best equipped in America for instruction in cotton manufacturing.

The following firms have made donations of their machinery:

The Beattie Mfg. Co., Cohoes, N. Y.; Hemphill Mfg. Co., Pawtucket, R. I.; Geo. D. Mayo Mfg. Co., Laconia, N. H.; Scott and Williams, Philadelphia, and Wildman Mfg. Co., Norristown, Pa.

OPPORTUNITIES IN THE SOUTH.

Mr. Richard H. Edmonds, Editor *Manufacturer's Record*, has compiled and issued in pamphlet form, an article entitled "Sunrise in the South."

The article is a clear and convincing exposition of the vast wealth and opportunities that lie in the Southland, and is a plea to those who have left the South to find opportunities elsewhere, to return again to their birthplace and share in the even larger degree of prosperity that is rapidly developing.

The enormous opportunities presented by reclaiming wet lands for agricultural purposes are set forth at length. The varied crops of the South insure prosperity, as the failure of one would not paralyze the entire section of agriculture.

The railroad business is dealt with in an interesting manner and its close relation to the manufacturing interests is very clearly shown.

The vast opportunities for export trade with the Orient with its 600,000,000 inhabitants, which will be afforded with the completion of the Panama Canal is another argument for the rapid growth which is predicted.

INDUSTRIAL FILTER EQUIPMENT.

(Owing to the last illness of the editor of COTTON, Mr. Henry G. Kittredge, the following article in the June issue of COTTON contained several errors and for this reason it is reprinted entire in the July number.)

Southern cotton and hosiery mills, operating their own dyeing, bleaching and finishing plants, will be interested in learning that the Roberts Filter Mfg. Co., Philadelphia, has just completed the installation of the filter equipment for the city of New Orleans, La. This filter plant has a daily capacity of 40,000,000 gallons, and is considered a model plant in efficiency and scientific operation. Some of the most delicate and accurate filter controlling apparatus known is used in operating this huge system.

Other city plants recently installed by this filter company are those at Manchester, Va., Decatur, Ala., Columbus, Miss., Farmville, Va., Sanford, N. C., and Henderson, N. C.

At the present time this company is completing for the American Sugar Refining Co., at Chalmette, La., a filter plant equal in size to most city plants.

While the Roberts Filter Mfg. Co. installs the largest kind of city and industrial filter plants, it must not be supposed that it neglects the business of the smaller textile plants. In fact, its large general filter business enables it to devote a special department to this smaller but equally important business. In proof of this it may be said that highly satisfactory plants have been designed and installed by this company for the Richmond Paper Co., Richmond, Va.; North American Lace Co., Philadelphia, Pa.; Auger & Simon Silk Dyeing Co., Paterson, N. J.; Cluett, Peabody Co., Troy, N. Y.; Crawley Clark & Co., Newark, N.J.; Stott Woolen Mills, Stottsville, N. Y.; Capron Knitting Co., Utica, N. Y.; Omo Mfg. Co., Middletown, Conn.; and the Georgia State Sanitarium, Milledgeville, Ga. All these plants are designed with a view to the most economical operation consistent with the highest efficiency.

In these days of close competitive methods it may be of interest to know that this filter company makes a close study of local water conditions in order to produce the highest form of economical and efficient water filters, and this is a matter of more than passing interest to Southern mills contemplating the purchase of filters for purposes of mill economy, convenience and elimination of time lost in shipping North for finishing.

Only recently the Roberts Filter Mfg. Co. has completed a very desirable and instructive catalogue on water filters and the problems of pure water for industrial purposes, and if any of our readers are interested in this, a postal to that effect will insure their obtaining a copy free of charge.

WINDSOR HOTEL OF PHILADELPHIA.

No clearer demonstration of the virtue of fair dealing and enterprise could be presented than that afforded by the success which has come to the Windsor Hotel, Thirteenth and Filbert streets, Philadelphia, under the management of Waldo T. Brubaker.

Mr. Brubaker assumed the management of the Windsor in 1907, and every year since that date has seen the hostelry add to its facilities, and advance in public esteem. The history of the Windsor is typical of changes that have occurred in the development of Philadelphia and surrounding country. In 1860 the hotel was known as the Smedley House. In those days, and for many years afterward, the hostelry was conducted after the manner of a country tavern, and was known far and wide among farmers and rural townsmen of Pennsylvania, New Jersey and Delaware.

A wide porch ran along the front of the building, and extensive, commodious stables stood in the rear. Many of the hotel's patrons drove many miles from rural districts and were glad to find in the heart of the business section a "tavern" which made good the ancient caravansary inscription, "Food and Shelter for Man and Beast."

The Windsor stands to-day one of the largest and best equipped houses in Philadelphia. The building has been constantly added to in recent years, the latest addition being a large building adjoining at the left, the first floor of which has been converted into a private dining room large enough to accommodate an immense company. The floor is of polished hardwood, making the room easily convertible into a dance hall. This room is in two sections, and communicates with the upper floors and kitchen by private stairways and halls.

In the basement is a private ice-making plant and the largest hotel power plant but one in Philadelphia. Here also is located the bakery which furnishes the table with fresh bread and pastry at all hours. Under the management of Mr. Brubaker the quality of the cuisine has been advanced to meet the most exacting modern demands. Banqueters have come to recognize the excellence of the service

and constitute a regular patronage. The Windsor is located midway between the two great railroad terminals of the Pennsylvania, and Philadelphia and Reading Railroads, and this in itself is one reason why this comfortable and inviting house claims such a generous patronage among the commercial men of the country.

RATEAU-SMOOT STEAM TURBINES AND GENERATORS.

To make coal produce more power is the present problem of the owners of power plants. Saving steam means saving money. Many plants, with non-condensing engines, are extremely wasteful of steam.

The Ball and Wood Co., of Elizabethport, N. J., is manufacturing the Rateau-Smoot low pressure steam turbine engine which increases the output by 50 to 100 per cent. with no increase in coal consumption.

The Rateau-Smoot low-pressure turbine is operated by exhaust steam, making use of it between the limits of the pressure of the atmosphere and the vacuum obtained by means of a condenser. It is a turbine of the impulse type, the entire expansion of the steam taking place in the fixed vanes. This is undoubtedly the most suitable type for low-pressure work, and the Rateau-Smoot design gives the best results as regards efficiency and absolute freedom from breakdown.

As there is no expansion of steam in the moving vanes of the turbine, there is no difference of pressure between the inlet and outlet sides of each rotor. Consequently there is no tendency for steam to leak past the tips of the blades. On this account the clearances in this turbine are extremely large, running up to ten times the amount possible in a turbine of the type where the steam expansion takes place in the moving vanes, and giving absolute immunity from blade strippings, an accident so frequent and disastrous with turbines of that type where small clearances are a necessity.

The Smoot generators are designed in both direct and alternating current types and arranged for direct connection to the turbine shafts through flexible couplings which relieve any excessive torsional strains when starting or stopping. The generators are of the open frame type, all their working parts being exposed to the view of the attendant, allowing them to be cleaned and properly cared for without dismounting. The commutation in the direct current machines is perfect, and there is no more sparking at the commutator than in the collector ring of an alternator. In designing these machines, special attention has been paid to the low degree of temperature rise above the surrounding atmosphere. The entire unit is of heavy, massive construction and neat design, the turbine and dynamo being mounted on a cast iron sub-base.

The great diversity of cases in which low-pressure turbo-generator units may be advantageously employed, and the widely varying conditions under which they may operate, make each one a subject for individual study in order to obtain the best results.

Taking account of all losses, and assuming that all of the steam from a reversing engine is passed through turbines of sufficient capacity, the power of the engine would be represented by 820, and of the turbines by 1510.

The steam enters the turbine blades, first stage at an absolute pressure of 13.2 pounds, and is expanded through the successive stages to an absolute pressure of 1.5 pounds, or approximately nine expansions. It is utterly impossible to maintain low back pressure on the low-pressure piston of any compound mill engine of the reversing type, or to undertake one-third of this number of expansions.

The Ball and Wood Co. are always glad to send one of their engineers to take up a case in person with a prospective purchaser, and estimates, specifications and preliminary lay-outs will be submitted on application.

TAVELLA'S SHUTTLELESS LOOM.

The chief characteristic of this loom is that it produces cloth without the aid of the ordinary loom shuttle. It is the first loom of its kind adapted for weaving good marketable cloth from almost any kind of stock. This shuttleless loom can put in ten colors as easy as it can four or six such colors, hence it will be found of great advantage in that class of work. The pattern is produced through the simple building of a "weft presenting chain" which never fails to serve the color of filling, as called for.

As the loom is operated without shuttles or shuttle boxes, the cost of all such with their attachments is entirely eliminated in its construction. The loom is based on the simplest mechanical principles. It has but one main shaft, on which all the necessary parts for the working of the whole machine are attached. This arrangement helps to reduce its cost of construction to a minimum.

This new type of shuttleless loom needs only one large sized bobbin of each color required for the pattern wanted. It will automatically take its own filling as required, hour after hour, throughout the whole day. It makes no mistakes in the selection of the colors needed for its design, which is absolutely controlled by its "weft presenting device," referred to above. Another special feature of the loom is its "filling carrier" which is adjusted and timed so as to cut, carry, and then let go each pick or thread of its colors without any failure to perform its mechanical functions exactly right in each instance. The manufacturer can therefore depend on that special feature of the loom also.

The selvage is produced by a special selvage pattern mechanism, through which the outside edge of the same is firmly held to its inner part. This shuttleless loom also has a new "filling trimming device" through the action of which a marketable fabric, with good firm selvage is positively secured. The simplicity of its construction is very evident at a glance. It has a wide range of fabric production including also special oriental rug weaving, and even the finer silks. This machine is, therefore, a valuable adjunct to any mill manufacturing such goods. With its large bobbins once properly wound, the loom can be operated all day long with little or no attention beyond "piecing-up" such warp threads as may break in the weaving. It may therefore be confidently claimed that a saving of at least 20 per cent. in the cost of weaving can be realized by the users of this make of loom.

STANDARD SPECIFICATIONS FOR BELTING.

The New York Leather Belting Co. has been most persistent in advocating the adoption of standard specifications for leather belting by manufacturers, on account of the many fraudulent methods practiced by some unscrupulous concerns.

It is probable that in the manufacture and sale of leather belting, there is more room for fraudulent deliveries and misquoted values than in any other field. The average buyer of belting is not a leather expert; it is dif-

ficult for him to distinguish between the first quality leather belt cut from center stock and belly stock belt, provided both are polished up and made slick and shiny. The buyer of belting must depend largely on the claims of value which the manufacturer makes for his goods; he rarely sees the belting when it is delivered, and he probably could not tell whether he was getting best quality, even if he saw it.

Knowing this condition to be general, some belting manufacturers have quite generally taken advantage of buyers; they have slashed prices, made claims of highest value, and have often delivered goods of inferior qualities on these claims. In many cases where bids have been asked on specifications of the highest type, there has been a difference of 50 per cent. between the highest and lowest bidders. In many cases the lowest bidder could not buy raw material of the best quality at the price at which he agrees to furnish the finished product.

By having manufacturers adopt a uniform system of cutting, so that each width of belting is cut from some fixed location in the hide, the user of belting will be able, by comparing this piece with a belting butt cut into strips, to check with certainty whether he is having delivered belting cut from this location or from some location nearer the belly.

The New York Leather Belting Company has anticipated the concerted action among manufacturers and has already adopted a standard for making its well known Phoenix belts.

The Phoenix specifications may be stated as follows:

Selection of leather: Hides of four-year-old steers, without flaw or blemish.

Tanning: Oak bark, slow process, without use of chemicals.

Currying: By a secret, scientific process.

Stretching: Centers and sides stretched separately.

Cutting: Strips are cut not in excess of 4 feet from tail toward shoulder in the rough butt. Every size of strip is taken from a fixed location. Never more than 15 inches from backbone to outside edge of strip are used in Phoenix grade.

The method of cutting the hide for Phoenix belts, is best shown by means of the accompanying illustration.

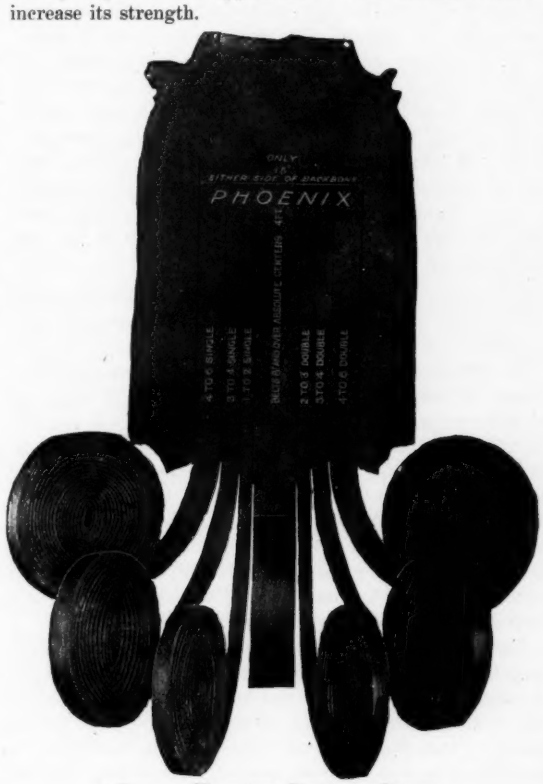
Very few hides on the market are suitable for first-class belting. The cowhide is unsuitable, as it is thin, is not uniform in thickness and lacks in firmness of texture. The sharp angles of the hip bones tend to form pockets which injure it for belting purposes. The excessive and prolonged stretching of the hide, and its subsequent complete relaxation, due to calf bearing, also make it unsuitable for belting purposes. The hide of the bull has its drawback, as it is coarse and hard, with the neck full of wrinkles, causing a variation in the thickness and run of grain of the leather.

The best hides for belting are taken from the American steer raised on the open range and killed in the month of October, when about four years of age. During the fall of the year, the animal is in its best physical condition and the hide is almost entirely free from grubs.

Tanning. The neck, legs and belly of the hide are unsuitable for belting and are trimmed off before tanning. The remaining part, known as the belting butt, is about four feet wide by six and a half feet long, with that part directly over the backbone as the center. The belting butt is first soaked in spring water to wash out the dirt and is then treated with lime water, which loosens the hair and skin, making it easy to remove them.

The hide should be tanned with oak bark and by a slow process, which requires nine or ten months before the hide is ready for the market. Tanning solidifies and preserves the gelatin of the skin, converting it into leather. The fibrous portion of the hide is protected from the joint action of air and moisture and at the same time the tenacity and suppleness are not injured.

It has been found possible to chemically tan hides in a very much shorter time and therefore cheaper than by the oak bark process, but such hides are lighter in weight and stretch so that they are unfit for belting purposes. The chemically tanned belt may be increased in weight and made to look like an oak tanned belt by filling in the pores with glucose, sugar of lead or other material, but this, of course, merely improves the appearance of the belt and does not increase its strength.



CUT OF HIDE FOR PHOENIX BELTS.

A green hide, weighing 70 to 75 pounds, after being trimmed and tanned by the oak bark process weighs only about one-half as much.

Physical Characteristics of the Belting Butt. The fibers along the center line of the butt (over the backbone) are stronger and more dense than those farther from it; if a butt was cut along this line and a belt was made with one edge corresponding to this center line it would be more elastic on one side than on the other and would not run true on the pulley. As the central portion of the butt is less elastic and stronger than the remaining portion, and as by making the center of the belt correspond with the center of the butt is can be very evenly balanced, it is the practice to cut the larger belts from the center of the butt. The shoulder part of the hide is coarse and wrinkled and should be removed from the belting butt, leaving only about four feet in length available for belting. It is possible to work or iron out the wrinkles in the shoulder piece, but the tex-

ture is not uniform and it does not make first-class belting.

After the shoulder has been removed, the butt should be cut into three pieces—a center and two side portions. The width of the center portion is cut the exact width of the wide belt into which it is to be made. This width is determined by grasping the outer edge of the butt near the shoulder and doubling it backward; the point where it kinks or forms a fold shows where the closely knit portion adjacent to the backbone disappears. If this point shows well in toward the backbone an 8 inch center is taken out; if further removed a wider center is cut. The part of the hide between the flanks and the central zone of dense and strong fibers which has been removed is quite uniform in strength and density.

Currying. The parts are then curried, making the hard and flexible leather soft and pliable, without affecting its strength and vitality. The first operation is to shave off the membrane and fleshy particles, after which the leather is washed and scoured by machinery. A pure animal grease should then be worked into the leather evenly and thoroughly, while both the leather and the grease are cold and the pores in their normal condition. While still damp the leather should be placed on the table of a machine and under slight pressure the fibers should be rubbed from the butt toward the shoulder. Any thick spots in the hide must be planed off.

Stretching. The hide, still damp, should then be placed in clamps and stretched. These clamps must be such that the leather will be stretched evenly.

The stretching of the butt is one of the most important features in the manufacture of the belting. It must be stretched evenly and to a sufficient extent, or it will not run true and will stretch excessively when the belt is placed in service. The clamps of the stretcher indent and discolor the leather, and various methods are used to eliminate these marks in order to use the greatest possible percentage of the belting butt. This often results in insufficient stretching, distortion of the grain of the leather, and the inclusion of the flabby cheek leather to the right and left of the tail, which is spongy and unfit for good belting.

The better practice would seem to be to use a substantial clamp that would grasp the leather firmly all the way across the piece, pulling it evenly and holding it rigidly while it dries. Stretching a belt to its limit takes out all of the elasticity; therefore after the hide is removed from the stretchers it is dampened slightly to draw it up a bit and furnish it with the elasticity that a belt must have to accommodate itself to various conditions of strain.

Finishing the Leather. The next process is to "jack" or roll the piece on a special machine, rolling out all unevenness, condensing the fibers of the leather and making it flat and pliable. The pieces are hung up to dry, after which they are moistened and piled when the jacking process is again repeated on a polishing machine with a different type of roller from that used first.

Cutting the Belt Strips. The method of cutting the belt strips from the finished pieces, used by The New York Leather Company, is as follows: The centers, as previously described, are taken out before the hide is curried. All main driving belts are made from the centers; the width of the center piece is governed by the texture of the hide. The thickness of the hide increases as it gets farther away from the backbone and the problem in cutting the two side pieces into strips is to have each width of belt taken from a fixed location on the hide so that the pieces can be matched and will be of uniform thickness. It must be understood that strictly first-class belting is taken from the section about four feet long, measured from the tail, and within 15 inches either side of the backbone. A second quality of belting may be taken from the strip six inches wide either side of this section. The remaining part of the hide is useless for good belting.

Of the 26 or more square feet in the hide, as it is received from the tannery, only 14 square feet are thus suitable for good belting—the remaining part must be sold at a small cost to be used for other purposes. By using part of it for belting, making the strips longer than four feet, the manufacturer can afford to sell his belt at a lower price, but it will not prove as satisfactory to the buyer and will be more expensive in the end.

The narrower strips are taken from either side of the center, the width of the piece depending on the width of the center which was removed and whether the increase in the thickness of the hide is gradual or precipitate. The pieces are sorted, matched, lapped and cemented into continuous strips and then finished.

How to Distinguish Between Good and Poor Belting. The most important problem which confronts the purchaser is to know just how to distinguish between high and low grade belting. In the first place he should buy belting on a rigid specification, and then what is more important, he must see that the specification is lived up to.

Fortunately nature has provided a means by which it is possible to check closely the quality of the leather and the approximate location from which it is taken from the butt. By bending a piece of belt the nature of the pit or kink will indicate the approximate location from which it is taken. Therefore if the large user of belting has a belting butt with strips cut, he can check the belting purchased with it.

Belting which is "loaded" or not properly prepared can be detected by making a physical test of its strength and elongation. For obvious reasons test pieces should be taken from parts of the coil than the ends. Finally, every large user of belting should keep a service record of every belt in his shop. This may very readily be done, when proper provisions are made for belt maintenance, at little or no expense.

THE JUNE ISSUE OF "GRAPHITE," published by Joseph Dixon Crucible Co., gives many interesting notes regarding the use of graphite in various lines.

THE AMERICAN PULLEY CO., of Philadelphia, has opened a branch store in Chicago, with a complete assortment of wrought steel pulleys and ash belt pulleys.

THE FIRM OF HARDING, WHITMAN & CO. will be dissolved on June 30, 1909. A new firm is to be organized under the firm name of William Whitman & Co., by Messrs. William Whitman, William Whitman, Jr., Arthur T. Bradlee, Malcolm D. Whitman, and Louis H. Fitch. William Whitman & Co. when organized will continue the business of Harding, Whitman & Co., except that on and after July 1, 1909, no further orders will be taken for the Whitman Mills. William Whitman Co. will as soon as organized act as selling agents for the Arlington Mills, of Lawrence, Mass.,